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INDIANA'S NEW STATE ASSOCIATION.

Indiana has about 150 privately owned central-station companies, and of these one-third are embraced in the membership of the recently formed Indiana Electric Light Association, which held its first annual convention at French Lick last week. About 30 stations were represented at the meeting, or 60 per cent of the active membership. This is not a bad showing, considering the proportions of the memberships of other societies which attend annual meetings, but, compared with the whole number of companies in the State, it will be seen that only one-fifth were represented. For a first convention the attendance was creditable. The association is only nine months old, and as it develops it will undoubtedly embrace a large proportion of the existing companies. It would seem that an active-membership list of considerably over 100 companies ought to be comparatively easy of realization, particularly with the moderate dues of the association, ranging from $2.50 a year for the plants in the smallest cities to $20 a year for the companies in the larger cities in the State. The new organization seems to have the germs of vitality in it, and there is no reason why it should not become one of the most flourishing of the State associations.

Representatives of the manufacturers and supply dealers attended the convention in considerably larger number than the central-station men themselves. This is often the case at other conventions. Possibly the plant managers can learn something from the alertness and enterprise of the men who sell electrical apparatus. The supply men turn out without fail because they believe it will be to their advantage individually and also on the broad principle of supporting the industry. The conventions ought really to be of much greater importance to the men selling electricity than to those selling apparatus, to say nothing of the great desirability of united action on the part of public-service companies on questions of public policy. But there are still many central-station men who refuse or neglect to make the comparatively slight effort necessary to give the conventions the support and prestige of their adherence and presence. We hope and believe that with the growing realization of the responsibilities of managers of public-utility corporations, to which Mr. T. C. McReynolds referred in his presidential address, there will be few station managers who will remain indifferent to the need of supporting the State and National associations. And it is the men in the smaller cities and towns who need the help of the association the most and who should be—but often are not—most zealous in its support.

The program of papers presented at the first Indiana convention was an excellent one. The first paper, on "Central Power-Station Practice," by Mr. P. H. Palmer, of Kokomo, with its useful analysis of station operating costs, frankly divulged from practical experience, was alone worth attendance to the convention. The other papers were also worth while. The discussion of the meeting centered about the tung-

sten lamp and the relation of central stations and dealers in the sale of current-consuming devices. Mr. C. C. Perry, of Indianapolis, was elected president, and in his strong hands the Indiana association, now apparently firmly established, should surely advance to greater usefulness.

The Michigan Convention.

The convention of the Michigan Electric Association, held last week at Detroit, far exceeded in attendance all previous conventions of that association. The topics taken up were confined to three specific subjects, and one session was given to each. At the opening session, devoted to lamps and illumination, a gratifying increase was shown in the system of special lighting of downtown streets by means of arches of tungsten lamps suspended from span wires. As regards the use of the tungsten lamp in general for interior work, the novelty has very much worn off during the past year, and practically all progressive stations are a unit in the decision that the tungsten lamp has been most beneficial to the industry by enabling business to be secured which heretofore has been out of reach. The general effect has been an increase in gross revenue, although temporary decreases when tungsten-lamp installations have first been made are frequently noted. In one session given to electric-power subjects, special attention was paid to the application of curve-drawing wattmeters to power consumers' installations. President Hillman is an enthusiast as to the advantages of such curve-drawing instruments for the purpose of giving both the power company and the consumer information. The advantages of their use can best be brought out by specific examples of benefits derived. To the average central-station man perhaps the vigorous advocacy of the frequent use of such instruments among power consumers may look like an attempt to help out the manufacturing companies to extend the sale of expensive instruments. To judge from some of the experiences related at the Michigan convention, however, the central station has been the first to take the initiative.

One of the most important uses of the curve-drawing instrument, on both light and power loads, is to show the consumer just at what hours electricity has been used. Frequently the record indicates use by janitors or watchmen which the consumer little suspected, and which he had previously charged up to the inaccuracy of the company's meters. As a method of settling complaints of this kind, the curve-drawing wattmeter or ammeter is very useful. These instruments may be also very useful to give both the central station and the power consumer an accurate indication of the power required by various machines in actual operation. Such information is useful to the central station making up its statements of fixed charges caused by maximum demand, and also in figuring on new installations. In some cases the consumer has discovered from the charts that his employees are not working the machinery in a way to get the greatest output per day. In another case brought up at the convention, where a lighting consumer had bitterly complained of his bills, the curve-drawing instrument revealed the fact that 60 per cent of the total was being used by the janitor in sweeping out at night. The result thoroughly satisfied the consumer and showed him that he was not being over-charged; otherwise, he would have continued to consider the light needed by the janitor as of no consequence on the monthly consumption. The use of central-station power for electrolytic and electrometallurgical processes received a little attention, and it is evident that there is an increasing amount of this work in Michigan, where much water-power is available, and where power can be sold very cheaply during some hours of the day. One of these uses, already well established in one large factory, is the electrolytic production of bleaching solution. Another is electric welding in the manufacture of small metal articles. It was also mentioned during one of the discussions that one large water-power company is figuring on the electrolytic production of oxygen for a large consumer during the hours when the load on the water-power plant is the lightest.

International Conference of Telegraph and Telephone Engineers.

The *Transactions* of the Telegraph and Telephone Conference, held at Budapest last year, have now been published, and make a quarto volume of about 250 pages, finely illustrated. It is published in French and in German, the two languages running side by side in official texts, but appearing in indiscriminate succession among the papers. English and Italian papers have been subjected to translation. Fortunately, English units of length and mass have also been translated, in most cases, into international metric equivalents. One valuable outcome from the conference, as manifested in the *Transactions*, is the collection of a number of valuable telegraphic and telephonic statistics into a single volume for international reference. Another noteworthy result of the conference is the evidence of the advantage that pertains to placing the management and technical disposition of both telegraph and telephone circuits of a country in the hands of the same staff. In this country, although the telephone companies lease many circuits for telegraph service in private offices, yet, broadly speaking, the telegraph wires are exclusively in the hands of telegraphists, and the telephone wires in the hands of telephonists. There would be advantage in a union of these interests, if the financial situation were favorable to such a merger. The Budapest conference was strictly European, and it is to be hoped that the United States will be represented at the next conference, which is scheduled for 1910. Our telephone systems are second to none in the world, largely because engineering talent has been amply employed in their development; but our telegraph systems are much behind the times, and are yearly growing relatively worse, largely for the corresponding reason that so little engineering talent is nowadays here employed in telegraphy. Participation in such meetings would have a good effect in making better known to foreign leaders wherein we excel technically, and in impressing upon our representatives wherein we are deficient. At one time Americans took a leading part at international electrical meetings, but in recent years we have ranked with China in abstention. It is to be hoped that this is not an indication that in this country all interest has finally become absorbed in the commercial side of engineering, and that its scientific and technical aspects not immediately representing dollars, are no longer considered worth attention.

More Data Concerning Tantalum.

A recent lecture before the Royal Institution by Alexander Siemens gives a very interesting view of the present state of the tantalum industry. As is well known to our readers, the tantalum lamp, although badly beaten in efficiency by the tung-

sten, is still in wide use, especially in Germany and on 220-volt circuits. Moreover, in addition to its uses in incandescent lamps it bids fair to have other important commercial applications particularly when proper development of its ores, which are very widely distributed, shall tend to bring down its cost when used in quantity. At the present time it is obtained very largely from tantalite, a raw material having the advantage of being practically free of niobium, which, having a lower melting point than tantalum and being rather difficult to separate from it, is an undesirable constituent in the ore. The metallurgy of tantalum begins with obtaining it from tantalite in the form of a double fluoride of tantalum and potassium. This is then reduced by metallic postassium to the form of a black powder.

This method of production is an interesting one in view of the fact that it would have been commercially impossible until within a few years, because only recently has potassium been obtainable in commercial quantities at a price which would permit of such use. The powder thus obtained is melted *in vacuo* in an electric furnace, thereby obtaining small buttons of very nearly pure tantalum. The present commercial tantalum is decidedly purer than that obtained at first and more uniform in quality, so that it is now possible to draw it into wire of a tenuity not practicable in the beginning of its utilization. Commercial wire for lamps is now produced barely .03 of a mm in diameter, the standard diameter of the earlier tantalum filaments being .05. The improvement in purity shows in a decrease of the specific resistance and an increase in the temperature coefficient of the present commercial wire as compared with that at first obtained. The tensile strength of the commercial wire rises to 57 tons per square inch, which is comparable with the best of steel wire.

As regards other commercial applications other than to incandescent lamps, these have not been fully developed on account of the cost of material. For chemical purposes tantalum gives considerable promise, inasmuch as it is untouched by all ordinary agents below 300 deg. C., and its general characteristics, which are very like those of steel, enable it to be applied with advantage instead of steel, where it is of the utmost importance to avoid rust. One use of considerable interest is for pen-points. It is found that it is admirably suited for this use and wears away less rapidly than steel. Curiously enough, it is improved in this function by a slight oxidation prior to its final polishing, which apparently increases the hardness of the surface and consequently the wear of the pen very much. At high temperatures, dull red heat for instance, it tends to absorb, like many metals, gases, especially hydrogen and nitrogen, and becomes brittle, so that its efficient use is confined to more moderate temperatures. At still higher temperatures it oxidizes on the surface and burns, so that a very thin wire can be ignited by a match. When used in an electrolyte it has, as has been known for some little time past, convenient application as a rectifier. Altogether, the more recent experiments with tantalum tend to increase one's estimate of its general value in spite of the coming of the tungsten lamp as an active competitor in incandescent lamp industry. Of the rare metals used for lamps, tungsten seems to hold the field for incandescent filaments, tantalum and osmium being apparently doomed to a subordinate position, however useful the former may be for certain purposes. Dr. Siemens gives an interesting note on the production of osmium, which of itself is quite sufficient to show the improbability of its assuming a large importance in spite of its undeniable possession of unusual radiating properties. The total production of osmium per year amounts to only about 8 kilograms for the whole world, of which 5 kilograms or thereabouts are required for medical and chemical purposes. The production of tantalum he does not state, but it is so much greater than this as to admit of no comparison, and should its general uses increase, which is quite certain, owing to its wide distribution it can be obtained in reasonably large quantities.

The Luminous Equivalent of Radiation.

A recent number of the *Bulletin* of the Bureau of Standards contains a long paper by Mr. P. G. Nutting on the general problem of the luminous equivalent of radiation. The paper points out that the terminology of the subject is much confused. The word "light" is used by some writers to designate the subjective physiological sensation, and by others to designate the objective stimulus which gives rise to the sensation. There is much need for a revision of terms and definitions, so that physical and physiological researches may be expressed in common terms. If we confine ourselves to a small element of the visual spectrum—say that lying between the limits of 0.5μ and 0.51μ—so that we only consider what is practically one color of light at a time, the physiological stimulus produced depends upon the intensity of the radiation in that color, but not in a simple proportion. If we increase the intensity of radiation in that color, we increase the sensation, but in a manner which is different in different parts of the spectrum, and is not uniformly graded in any one part. Moreover, the sensation depends upon the duration of the stimulus, increasing for the first tenth of a second at a rapid rate, reaching a maximum value in less than one second, and thereafter slowly diminishing with time in a manner that depends upon the intensity. It is supposed that if for each element of the spectrum the intensity effect and the duration effect could be properly assigned, the total sensation would be the sum of the sensations due to each element. Even this proposition, however, is open to discussion, and it has been asserted that the total sensation stimulus is generally less, but occasionally more, than the sum of all the individual component stimuli, if each acted alone.

It may be judged from the foregoing how difficult a task lies before the investigator who endeavors to express completely and accurately the stimulus equivalent or light sensation of any assigned intensity of radiant power, within the limits of the visible spectrum. The eye may be likened to an alternating-current instrument which responds to alternating electric currents in a certain complex manner. Various frequencies of alternating current affect the instrument differently and perhaps in a different manner when the pointer is at different parts of the scale. All we can do for the present is to observe the increase of deflection as we gradually increase the strength of current of one frequency at a time, and then gradually accumulate data as to the cumulative effect of currents of different frequencies.

Western Union Receives Large Award in Telephone Case.

Mr. Everett W. Burdett, special master in the case of the Western Union Telegraph Company against the American Telephone & Telegraph Company under a contract made in 1879 under which the former retired from the telephone field, has reported an award to the Western Union Company of $2,579,914 and 20,087 shares of stock, the total aggregating about $5,000,000.

The contract out of which the litigation arose was entered into at a time when a serious conflict for supremacy in the telephone field was imminent between the Western Union and the National Telephone company, now the American Telephone & Telegraph Company. The National Telephone Company thought it best to compromise, and the terms of the compromise were embodied in the contract in litigation.

Under it the Western Union Telegraph Company agreed to go out of the telephone business and turn over all its telephone patents to the Bell company, the latter agreeing not to interfere with the telegraph business and to pay the Western Union 20 per cent of all rentals or royalties received from licenses or leases for telephones in the United States for a period of 17 years.

After this contract was made the Bell company gave exclusive licenses to companies in various parts of the United States for a certain percentage, generally 35 per cent of their stock, free of cost. For four years after the making of the contract the Western Union received an annual income from telephone royalties of between $400,000 and $500,000, but in 1883, when these stock transactions came to its attention, the Western Union entered a protest. The case was first given to Judge John Lowell as referee, who ruled that the Western Union was not entitled to recover. Judge Colt confirmed the referee's decision. The case was taken to the Court of Appeals, with the result that the Western Union was given a decision entitling it to 20 per cent interest in the shares of the Bell sub-companies, with accrued dividends, during the 17 years of the life of the contract.

The present case has been before Mr. Burdett since Feb. 1, 1904, when he was appointed by Judge Colt as a result of the decision of the United States Circuit Court of Appeals, handed down in December, 1903, in which the court ruled that the Western Union was entitled to an accounting, thus reversing the decision of the single justice.

The question before the master was not whether the plaintiff was entitled to recover, that having been decided affirmatively by the Circuit Court of Appeals, but as to how much stock and how much cash the Western Union should recover from the Bell company under the terms of the contract in dispute. Although the amount awarded is only about half the amount claimed by the Western Union, it is regarded in financial circles as a great victory for that company. The claim of the plaintiff was for 38,188 shares of stock, par value about $3,500,000, and $5,873,292 in cash. The master's report is a printed document of over 100 pages. If the parties are not satisfied they may then take exceptions, which will be argued later before the court. It is understood that the Western Union is willing to accept the findings, but that the defendant corporation will take exceptions.

Calcium Carbide Suits.

Judgment has been rendered before the United States Circuit Court of the Northern District of New York in two suits of the Union Carbide Company versus the American Carbide Company. Both decisions were written by Judge Ray, and both are in favor of the defendant. One suit was based on the product patent, 541,138 of Willson, of June 18, 1895. The validity of this patent is upheld, but no infringement is found, the judge holding that the "new product" patented by Willson as "crystalline calcium carbide existing as masses of aggregated crystals" is a new and special subdivision of crystalline calcium carbide and that when thus constructed infringement of this narrow claim is not made out. The other suit was based on the process patent, 563,527 of July 7, 1896. Infringement was not found because the patent refers to an arc furnace, while Judge Ray holds that the furnace used by the defendant is essentially a resistance furnace.

Government Telegraphs in America.

A recent bulletin of the U. S. Bureau of the Census gives some surprising data as to the extent of Government telegraphy and telephony in this country. In detailing the telegraphic and telephone operations of the Weather Bureau the bulletin states that during the year 1907 it operated 537 miles of telegraph and telephone lines, including about 96 miles of submarine cable. At the end of the fiscal year 1907 the telegraph was being used to supply 2280 places with daily forecasts, 734 places with special warnings, and 5998 places with emergency warnings, all at the expense of the Government. Through the service of governmental telegraphs, railroad telegraphs, telephones, railroad trains and mails, daily forecasts were being sent to 2,141,151 addresses, and through the cooperation of other telephone companies the dissemination of this information was materially increased. These lines rendered valuable service in obtaining aid for shipping in distress; in reporting inbound and outbound vessels to owners, maritime associations and others; and in affording residents in isolated places and others probably the only means of telegraphic communication.

During the year 1907 the Government had charge of the operation of telegraph and telephone systems in our outlying possessions. The length of such lines amounted to 65 miles in Panama, 484 miles in Porto Rico, 1403 miles in Alaska and 6438 miles in the Philippines, and in addition there were 2524 miles of submarine cable in Alaska and 1437 miles in the Philippines. More than one million (1,090,308) messages were transmitted over these lines during the year. Because of the excessive cost of maintaining land lines in the interior of Alaska, the use of wireless telegraphy is particularly desirable in that country. In 1907 a wireless system covering 107 miles was in operation, and other stations were contemplated which would furnish connections between Safety and St. Michael and the United States.

Another Large Mexican Hydro-Electric Project.

A large electric-power and transmission enterprise, backed by American capital, is the latest Mexican hydro-electric development. It will be operated under the name of the Nazas River Power Company, the organization of which has just been effected. Mr. G. L. Nies, of New York, financial representative of the company, who has been spending some time in Mexico on business connected with the project, is authority for the statement that not less than $10,000,000 will be spent in the construction of the hydro-electric plant and the building of transmission lines. Mr. J. A. Spofford, of New York, is president of the company; Mr. L. H. Hacker, vice-president and general manager, and Mr. C. A. Bobst, secretary. The hydro-electric plant will be located in the Fernandez canyon, situated 125 km above the city of Torreon. The Nazas River flows through this canyon and the initial water-power will be obtained by building a high dam across the narrow gorge. The initial capacity of the power plant will be 20,000 hp, which can be increased as the demands may require. Representatives of the company have been quietly at work securing contracts for electric-power for some time. It is stated that contracts have already been signed for all the 20,000 hp that the initial plant will generate. The transmission lines will run to the cities of Torreon, Gomez Palacio, Lerdo, San Pedro, Mapimi, Durango, Velardena and other places. The power will be used chiefly in mining operations and industrial plants. The concession for the enterprise was originally obtained from the Federal Gov-

ernment by Messrs. Juan F. Farias and Andres L. Farias, Monterey, Mexico, from whom it was purchased by the Nazas River Power Company. The contracts call for the completion of the big enterprise by Jan. 1, 1911. Mr. Walter F. Lineberger, of Torreon, Mexico, is the engineer in charge of the work. The company will maintain its Mexico offices at Torreon.

Electrical Show for Boston.

An electrical show, the first of its kind in Boston, will be held in the great exhibition hall of the Mechanics Building on Nov. 15 to 25, inclusive. The exhibits will include all the novelties in time, labor-saving and comfort-giving devices, as well as everything up to date in various other electrical lines. The decorations and lighting effects will, it is stated, be novel and elaborate. There will be special departments for the exhibits of amateur wireless operators, and the inventions and ideas of amateurs; prizes will be awarded for deserving suggestions or to inventors of practical ideas. The association promoting the exposition is known as the Electrical Exposition Association, of which Mr. Chester I. Campbell, a successful promoter of large expositions, is general manager. The president is Mr. C. W. Holtzer, and Mr. A. B. Tenney, of the Malden Electric Light Company, is vice-president. The executive committee includes Messrs. Stuart, of the Stuart-Howland Company; W. H. Atkins, of the Boston Edison Company; J. N. Keller, of the New England Telephone & Telegraph Company; Herbert S. Potter and Frank J. Stone, of the Electric Storage Battery Company. The advisory board consists of members of some of the large electrical manufacturing companies.

Expediting Telegraph Business.

The Postal Telegraph Company inaugurated recently a new method of handling its business between important cities and town which reduces very materially the time a message is in its care—i.e., from the moment it is accepted from the sender until its delivery to the addressee. This gain of time is effected, not by any improvement in apparatus or increased speed in transmission over the wires, but by the readjustment and concentration of office methods and the elimination of many handlings of messages, which consume time.

The means of accomplishing these results is simple. In the New York office the important wires are grouped on desks arranged in the form of a quadrangle, instead of being scattered all over the office, as formerly, the inner space of the quadrangle being occupied by clerks who take the messages the moment they are received and hand them over to the operators on the wires over which they are to be forwarded to their destination, in the case of relayed or through messages. Local messages are immediately put into a pneumatic tube and despatched to the delivery department. By the old method a relayed message was handled 10 times during its course from wire to wire in the office, with an inevitable waste of many minutes. The new system cuts down the handling from 10 to 1 with a corresponding saving of time. At the cities where the new system has been introduced the arrangement of the instruments and the method of handling the business are the same as those employed at New York.

The company reports that this improved internal method of expediting the traffic over the wires has reduced the time of transit so that its patrons may receive answers from Chicago, Boston, St. Louis, Denver, San Francisco, New Orleans and other points in less than 30 minutes after the messenger has been signaled to take the message. A maximum schedule time limit is fixed for the transit of every message in the operating, delivery clerks and messenger departments. The average elapsed time, for instance, from the time a messenger is called in New York to delivery to the addressee in Chicago is 15 minutes. In cases where the distance from office to addressee is short messages are frequently delivered in less than 15 minutes. The company makes no extra charge for this "Special Rush Service" as it is called.

Corporation Tax Plans.

The first step in the collection of the corporation tax was taken to-day when Acting Secretary of the Treasury Reynolds sent out to internal revenue collectors instructions for the compiling of lists of corporations within their districts. The corporations will be listed under five heads—financial and commercial organizations, public service, industrial, mercantile and miscellaneous. Their reports will have to be in early as the tax is to be collected for the present calendar year.

The question blanks which the corporation officers will have to fill out have not yet been prepared, and it is expected that nothing will be done in that direction until Royal Cabell takes his place as Commissioner General of Internal Revenue, succeeding John G. Capers, of South Carolina. It is recognized that the corporations could not answer the questions intelligently anyhow until near the end of the year for which the earnings are to be computed.

Telephone and Telegraph Legislative Investigation.

The legislative committee which has been appointed to look into the question of whether the public service laws of New York should be so amended as to place telephone and telegraph companies under the supervision of the commissions, held a preliminary meeting last week and is preparing to begin its work. Senator George A. Davis, who was chosen chairman of the committee, says that the committee will first investigate the telephone and telegraph companies in all parts of the State, to see whether they are now giving good service and determine whether the service could be bettered by putting them under the commissions.

Senator Davis also says that it is within the scope of his committee's powers to investigate the commissions themselves to ascertain whether they are performing the duties for which they were created. It is expected that public hearings will begin about Dec. 1 and that a report will be ready for the Legislature when it meets in January. In addition to the chairman the members of the committee are: Senators John Kissel and James J. Frawley, and Assemblymen Edwin A. Merritt, Jr., John Yale, Artemus Ward, J. A. Waters and Thomas B. Caughlan.

Patent Office Criticism.

At a meeting held in Washington last week, at which about 35 inventors were present, a permanent organization of inventors was formed, having for its object the correction of alleged patent abuses. The chairman of the meeting was Mr. W. P. Armstrong, and the secretary, Mr. J. J. O'Brien. During the meeting the Patent Office was sharply criticised, and manufacturing organizations were accused of systematically cheating inventors of their rights. Commissioner of Patents Moore, in replying to some of these charges, said that the inventors were too hasty and severe in their criticism of patent office methods and patent office examiners. If any faults exist in patent laws, he said, they are faults of the laws and not of the officials who administer them. A general meeting of the association formed is scheduled for some time in September.

New York Public Service Commission News.

The Public Service Commission of the First District of New York, without passing upon the reasonableness of the price of $300 a share which the receivers of the Metropolitan Street Railway Company offered to pay the receiver of the New York City Railway Company for 500 shares of the Bridge Operating Company, has granted its approval to the proposed transfer of the stock. The commission at the same time has ordered an investigation to be started to ascertain the condition of the Bridge Operating Company, which, under the plea that it is

organized as a business corporation and not as a railroad company, has failed to file reports with the commission. The commissioners have expressed the opinion that if the value of the shares has multiplied three times within a few years it is proper to investigate the question of rates and service.

The Public Service Commission of the First District has taken under advisement the application of the Long Island Electric Railway for permission to reduce its capital stock from $2,100,000 to $600,000. At a public hearing last week the company claimed that the increase of its capital stock to the present figure was made to cover paper assets, which were of no benefit to the company, and that it wanted the stock reduced to represent the real value of the company's property.

The Citizens' Tunnel Committee of Staten Island has presented to the Public Service Commission plans for a subway route that it is claimed will prove a solution for the transportation difficulties the Borough of Richmond now suffers. It is proposed that the Brooklyn Fourth Avenue line shall be continued and run from 101st Street in Brooklyn under the Narrows to Rosebank, S. I. The citizens of Staten Island also have some hope of securing an extension of the MeAdoo tunnel from Jersey City, through Bayonne and entering into their territory.

The Public Service Commission of the First District has accepted the invitation of the management of the State Fair, which opens at Syracuse on Sept. 14, to make an exhibit. Elaborate charts will be prepared which will show all of the transportation facilities of Greater New York.

The Public Service Commission of the First District, under the authority of the transportation corporation law, passed by the last Legislature, has taken the Fifth Avenue Stage Coach Company under its jurisdiction. This company operates a line of electric buses on Fifth Avenue, upper Broadway and Riverside Drive. The company holds a franchise giving it the right to operate over any streets in the city with the approval of the commission. The commission has called upon the company for a statement of rates, routes, transfer points, number and condition of cars operated, etc. The commission intends to investigate as to whether the service is adequate to the public demands.

The Public Service Commission of the First District has completed inspection of the Eastern Parkway, assessment subway route and the Coney Island and Fort Hamilton route in Brooklyn. Property owners along the former of these routes have signified their desire to have an elevated extension of the subway constructed by assessment, and a hearing has been called on the proposition for Sept. 8. The inspection of the Fort Hamilton line was for the purpose of ascertaining whether the assessment plan could be applied.

The Public Service Commission, Second District, has authorized the Deer River Power Company to exercise franchises in the village of Copenhagen, Lewis County, and to issue its capital stock to the amount of $25,000 to be used for the purposes of expense of organization and paying its indebtedness incurred in purchase of certain water-powers, riparian rights and land at High Falls on Deer River.

The commission has consented to the consolidation of the Plattsburgh Light, Heat & Power Company and the Lozier Light & Power Company, under the corporate name of Plattsburgh Gas & Electric Company, and given its permission that the companies may, pursuant to the terms of the agreement of consolidation, transfer all their property, franchises, etc., to the new corporation formed by such agreement of consolidation.

A petition has been received from the Babylon Electric Light Company asking for approval of an increased issue of capital stock from $45,000 to $75,000. The company furnishes street and house lighting by electricity in the village of Babylon and in its parts of the towns of Babylon and Islip, and contemplates an extension to the village of Farmingdale. The proceeds of the stock issue are to be used for the construction and improvement of its plant and distributing system, for the improvement and maintenance of its service, and for the discharge of lawful obligations.

Indiana Electric Light Convention.

Organized Nov. 24, 1908, the Indiana Electric Light Association held a special meeting in Indianapolis last January, but its first annual convention was held at the French Lick Springs Hotel, French Lick, Ind., on Aug. 18 and 19, 1909. The attendance was not large, about 80, of whom perhaps 30 were central-station men. But the program of papers was an excellent one, if short, and the association, under the direction of its first president, Mr. Thomas C. McReynolds, of Kokomo, demonstrated its vitality and gave promise of growth in numbers and usefulness. Mr. C. C. Perry, president of the Indianapolis Light & Heat Company—perhaps the most widely known central-station man in the State—was elected president and Mr. Fred Leslie, of Muncie, was re-elected secretary and treasurer. Two sessions were held and six papers or addresses were presented and briefly discussed.

OPENING BUSINESS.

The first session of the convention was held on the afternoon of Wednesday, Aug. 18. Mr. McReynolds was in the chair and Mr. Leslie, the secretary and treasurer, was at his side. In his opening address President McReynolds referred to the likelihood of a public-service commission in Indiana. While the bill had not passed at the last session of the Legislature, the subject will no doubt be taken up at the next session. The association should not wait until that time to reach its own conclusions in the matter. The organization can be a help to its members in this and many other ways.

The growth of the industry is in no way abating. Many companies will no doubt be able to show gross earnings of $10 per capita within the next 10 years. Rates have been reduced; many companies are now selling energy for certain purposes at less than 2 cents a kw-hour. Indications are that in the future managers of public-utility corporations must take greater responsibilities and assume heavier burdens; they must be alert to take advantage of all opportunities for advancement. The technical press and technical societies show the trend of development. Greater care must be exercised in the selection of employees. Improvement in the art requires increased intelligence and skill on the part of its followers.

Mr. Thomas Taggart, president of the French Lick Springs Hotel Company, delivered a pleasantly worded address of welcome. Mr. Taggart, who operates a commercial plant at French Lick, was afterward elected a member of the association and appointed on the advisory committee.

The secretary and treasurer expressed his regret that the number of central-station men attending the meeting was not greater. The association has 72 members and a satisfactory balance in the treasury.

Mr. P. H. Palmer, of the Kokomo (Ind.), Marion & Western Traction Company, read an excellent paper on "Central-Station Power Practice." The paper contained useful figures of operating costs from actual records. It will be presented in abstract in a following issue. Mr. Leslie and Mr. C. C. Perry, of Indianapolis, discussed the paper briefly.

MAYOR BOOKWALTER'S SPEECH.

Mayor C. A. Bookwalter, of Indianapolis, was present at the invitation of Mr. Perry, and he addressed the convention at the request of President McReynolds. He said it did a public officer good to attend a gathering of this kind, meeting men who try to please an indulgent public. The newspapers often attack public-utility corporations. They raise their rates for advertising at will, but want the service companies to reduce their rates. Publicity is akin to light, so there is an inconsistency in this. The newspapers should first pluck the beam from their own eye. Indiana will some day have a public-service commission; a reasonable law of this kind will be all right. But public-utility companies have a right to live and to do business at profitable rates. The men in the association should give their advice to those drafting the bill. The general public is more concerned in first-class service from first-class plants than in witnessing the ultimate forcing into receiverships of the men

who furnish that service. As a concrete instance of the proper way of doing things, the Mayor mentioned the new City Hall electric plant in Indianapolis. Mr. George M. Brill, of Chicago, is consulting engineer for the plant, and when he was asked whether the city should buy electricity or make it, he advised a contract with the central-station company, which, he said, could undoubtedly sell electrical energy to the city cheaper than the latter could make it. Mayor Bookwalter's speech pleased the central-station men, and they applauded vigorously.

TUNGSTEN-LAMP DISCUSSION.

"The Commercial Effects of the Tungsten Lamp and Its Later Developments" was the subject of a paper read by Mr. N. S. Merrill, of the National Electric Lamp Association, Cleveland. The relation between the lamp manufacturer and the central-station man is very close, the speaker said. The stations have found the tungsten lamps valuable in attracting much new business by low rates adapted to the new lamps. The new lamps stimulate a desire for more light. Stations with kw-hour rates based on current consumption of the old carbon lamps looked with some dismay on the lamps. But, as in the case of the introduction of the mantle in the gas business, these fears have not been justified. Public interest in lamps and lighting is aroused as never before. The tungsten lamp makes possible a degree of illumination which would have been prohibitive a few years ago on the score of expense. The residence customer who cuts down his current consumption for light by using the tungsten lamp is apt to install electric flatirons or other convenient electric devices, thus helping the day load and the load factor of the station. In stores the advertising value of the new lamp, with its white, color-true light, makes it of great value, but the lamp should be properly installed.

Never before has the central station been in such an excellent position to meet gas competition. There is no doubt, too, that the lamp will be improved; perfection has not been reached in three years. A 150-watt lamp has recently been added to the line to fill the rather wide gap between the 100-watt and 250-watt sizes. One interesting announcement made by the speaker was that the 220-volt tungsten lamp will soon be obtainable. Mr. Merrill dwelt on the advantages of series tungstens for street lighting. The lamp for this purpose is rugged, and there is no question of its merit.

Low-voltage tungstens are used for outdoor decorative and sign lighting. Lamps of 4 cp are large enough. These require low-voltage circuits, and 8-volt to 12-volt tungstens can be procured. They must be burned in series or series-multiple or with transformers if alternating current is available. The transformers should be controlled from the primary side. Voltage drop in secondaries must be small and the transformers should be operated at as near full load as possible. Sign and decorative lighting is most frequently done on a flat-rate basis, so that by the saving afforded by tungsten lamps a reduction in rate can be made to the customer, while the company secures a better return. Tungsten lamps are also being rapidly introduced for train and automobile lighting, often supplanting gas or oil. The pocket flashlamp is another form where the new filament is particularly advantageous. In closing, Mr. Merrill said that a broad policy on the part of the central-station man cannot fail to win in the end. Give the customer the best medium of converting electricity into light and he will appreciate it.

Mr. George C. Osburn, of the General Electric Lamp Works, Harrison, N. J., spoke of the opportunities afforded by the tungsten lamp of getting much lighting now done by gas companies. The series tungsten lamp is particularly useful for central stations furnishing street lighting. Compared with gas, the deterioration of incandescent mantles is much more rapid than that of tungsten filaments.

Mr. Charles H. Howe, of the Holophane Company, of Chicago, said the tungsten lamp should be used to place the central station in a better position in the eyes of the public.

Mr. R. W. Waite, of New Albany, brought up the question of using tungsten lamps in residence lighting. Did Mr. Merrill really think it feasible? Mr. Merrill did not see why not. If installed properly the lamp should prove adapted for houses or apartments.

Mr. Perry, of Indianapolis, said he uses tungsten lamps in his own house. In his judgment, the lamps are all right for this purpose.

Mr. J. H. Harding, of Laporte, explained that the trouble was in adapting the new lamp to existing fixtures designed for carbon lamps. Mr. Perry's house is a new house. Customers complain of the brilliancy of the light. As to the reduction of wattage, Mr. Harding attaches no importance to that objection. The company will get about a certain amount of money from the average man; it is better to have part of the demand for electrical energy go into irons and other domestic appliances using electricity in the daytime. The principal question is the proper installation of the new lamps in residences.

Mr. Howe agreed with the latter proposition, and said that a naked tungsten lamp should never go into a house.

Mr. G. E. Varney, of Danville, Ind., was not so sure about the tungsten in houses. A soft, mellow light is needed in the home; perhaps the new lamp is too brilliant, giving too much of a glare.

Mr. Howe pointed out that it is not necessary to have bright points of light with the tungsten; the indirect system of lighting can be used, for instance.

Mr. Harding inquired concerning the old fixtures. Customers have their houses equipped with fixtures designed for carbon lamps, and they do not feel that they can afford to throw them away.

Mr. Howe said the old must give way to the new; it is the law of industrial progress. But sometimes, as the older brother's clothes are cut down for the younger, the old fixtures can be made over for the new lamps.

CENTRAL-STATION HEATING.

The morning session of Thursday concluded the convention. The first business was the presentation of a paper written by Mr. W. H. Schott, of Chicago, on "Central-Station Heating." The paper was read by Mr. J. C. Hornung, of the Schott Engineering Company. The author said that central-station heating plants had been in operation for 25 years. Some have been successful, some have been failures. In the latter case the cause may have been that the plant was not properly situated for district heating or the plant itself may have been at fault. There are four systems: high-pressure and low-pressure steam and high-temperature and low-temperature forced-circulation water systems. To be a success a central-station heating plant should serve a territory of substantial size; its design should be efficient, but not too expensive; the type of construction should allow low depreciation; distribution equipment should be carefully installed; sufficient equipment should be placed on customers' premises, and all features of the plant should be given proper attention. If the situation is favorable and if installation and rates are correct, central-station heating plants may be made to pay either on a coal-burning basis or by using exhaust steam. Charts were used to show costs, income and financial results of a heating plant combined with an electric plant in an Indiana city of about 10,000 population. Mr. Schott said that the results in this case had been very satisfactory. In general he recommended central-station heating plants, suitably located, as good investments.

GREETING TO SISTER SOCIETY.

On the suggestion of Mr. C. A. Howe, supported by Messrs. C. C. Perry and J. H. Harding, the following telegram, signed by President McReynolds, was sent to Mr. H. W. Hillman, president of the Michigan Electric Association, then in session in Detroit:

"The Indiana Electric Light Association, in session at French Lick, extends its compliments and congratulations to the Michigan Electric Association."

NEW BUSINESS AND ADVERTISING.

Mr. A. P. Tills, of the Evansville Gas & Electric Light Company, read two short papers on "New Business" and "Advertising." He emphasized the importance of having sufficient

solicitors in the field. In hard times, especially, the company must keep in close touch with the people. Solicitors may be paid on a commission basis if necessary. Peak business will come without solicitation, but off-peak business will not. The speaker recommended a liberal policy of doing wiring at cost and selling motors and heating appliances at close margin. The way to secure new business is to go out and get it, said Mr. Tills, sententiously.

In relation to advertising, the speaker believes that but slight returns are received from advertising in the daily papers. Perhaps it may be advisable to place such advertising, but if so it should be treated as an expenditure for public policy and not for new business. Specialists in advertising by light may be sent out to interest storekeepers in lighting schemes—outline, sign and show window. This lighting is intended for advertising, not for illumination. Attention might be called to installations of this kind by advertising in the daily papers. Mr. Tills does not believe in the use of circulars unless followed up by solicitors.

Mr. Perry has used newspaper advertising in Indianapolis and believes it has been of benefit. At any rate, it has a favorable effect on the public; it gives the impression that the company is progressive and aggressive and "in the game."

Mr. G. E. Varney, who is engaged in the supply business in Indianapolis as well as the central-station industry in Danville, asked if central stations and electrical dealers and contractors might not co-operate in the getting of new business. In Buffalo there is a Tuesday Lunch Club, where the station men and the contractors get together. There has been some feeling on the part of the dealers and contractors because the station buys apparatus in large quantities and distributes it practically at cost. The dealer must have a margin, if only a small one. Perhaps if the consumer pays a fair price for high-class lamps or heating devices he will value them more highly.

Mr. Perry could understand Mr. Varney's position and appreciated his suggestion. But, on the other hand, the whole object of the central station is to sell electrical energy. The Indianapolis lighting company sells appliances practically at cost. If the "other fellow" does the work of marketing he is entitled to his profit; but he does not do the work of pushing the sale of current-consuming devices in a systematic manner. The company must take up the work of educational campaigns and spend its own money in considerable amount; it has the organization to do it. The station can reach its own customers; the supply man does not know who these customers are. It would save much money and effort if the station could dispense with its new-business campaigns, but Mr. Perry does not see how it can be done. The company itself is bound to push out to make its business grow.

Mr. Varney said that it was true that the dealer could not make the central-station's business campaign, but as this campaign is expensive, why not sell the appliances at a profit to cover this expense? Why could not an arrangement be made for co-operation with dealers on the basis of the station selling the appliance at a fair price, to be agreed upon, permitting a profit? Let the selling expense of the station be charged to profit-and-loss account, making prices for appliances at which the dealer also could sell at a profit.

Mr. Perry replied that the station must meet the conditions that confront it, particularly if there is competition in supplying electrical service, as is the case in Indianapolis. The company must make new uses for the sale of energy. It would probably be impracticable to rely on the dealer to push the central-station business.

Mr. Varney said that he was not asking the station to drop its new-business department, but simply suggesting that a proper price be charged for appliances. A reduction of a few cents in the price of a flatiron is not a great inducement to a customer in view of the cost of the energy for operating it.

Mr. Howe thought it well to secure the co-operation of the contractors.

Mr. L. E. Holderman, of Terre Haute, told of a plan of paying commissions to contractors by the central station for the sale of energy-consuming apparatus. For lamps this commission is 50 cents per customer plus 5 cents per 16-cp equivalent; for fans, 50 cents for 12 in. and 75 cents for 16 in.; flatirons, 40 cents and 50 cents. Lamps are sold to dealers at 2 cents less than the regular price, and motors are sold to them at 7½ per cent to 10 per cent reduction from retail price.

Mr. R. W. Waite, of New Albany, contended that the station might just as well have a reasonable profit on appliances put out. He heartily favors a policy of this kind, which can be brought about if the central stations will stand together.

USE OF FLUX-OF-LIGHT TABLE.

Mr. Charles A. Howe, of Chicago, with the aid of blackboard diagrams, explained the practical value of the Cravath-Lansingh flux-of-light method of determining the amount of illumination necessary for a given room. He illustrated the simplicity of the system by example. The table will enable anyone who uses it intelligently to lay out a lighting scheme, so far as the necessary wattage is concerned. Central-station solicitors will find it very useful. With it they will have confidence to go out and figure on nearly any lighting proposition.

LOAD FACTOR.

Mr. Henry E. Eells, of J. G. White & Company, New York, read a paper entitled, "How Can We Best Improve Our Load Factor?" He defined "load factor" as the ratio of average to maximum load. He showed that it is highly desirable to load the station to its full maximum capacity for safe operation, and said that a careful canvass of the community should be made to secure all available power business. Rates should be definite and strictly adhered to. Motor installations may be paid for in installments. One interesting suggestion related to the disposal of old machinery replaced by electric motors. The central-station company should exhibit a willingness to take this off the hands of the customer. Perhaps a sort of clearing-house association could be formed by the companies of, say, one State to dispose of second-hand machinery secured in this way. In going to a merchant for sign or advertising lighting, try to interest him also in power. If he is a grocer ask him to use a coffee-mill motor, and so on. Residences now afford an opportunity for day load with the numerous domestic electric appliances of the present day. The introduction of the tungsten lamp has had a direct influence on the load factor of the lighting-companies system. A satisfied lighting customer, made so by the tungsten lamp, is well disposed toward the day load.

Answering Mr. Leslie's question, Mr. Eells said that 40 per cent is at present considered a good load factor for a central-station system.

LIGHTNING ARRESTERS.

Mr. E. E. F. Creighton, of the General Electric Company, Schenectady, gave a lecture on lightning arresters, with practical demonstration. The apparatus consists essentially of a large induction coil and Leyden jars arranged for an impressed e.m.f. of about 70,000 volts. The equivalent needle-gap, choke coil and multi-gap arresters were explained and illustrated. The speaker said that the aluminum arrester is the only one to use on transmission lines of over 30,000 volts. Below that voltage down to 2300, there is a choice between the aluminum and multigap arresters, but, perhaps, the former should be given the preference. The multigap arrester has reached its limit of improvement. Its weak point is its limitation in time of discharge. The aluminum arrester is designed to charge for half an hour. Below 2300 volts the aluminum arrester is relatively expensive. On distributing circuits it is not commercially practical to use the aluminum arrester on account of its cost and the need of daily inspection. Arresters should be wisely distributed on distributing circuits to give the best results. A smaller number can be used in cities than in the open country.

ELECTION OF OFFICERS.

President McReynolds spoke of the high character of the papers and thanked the authors. He expressed regret that a larger proportion of the active members was not present, but

said he was satisfied that the association had gained a firm foothold and he had little doubt that there would be a larger attendance at the next meeting. He took occasion to thank the supply men for their attendance.

On the report of a nominating committee, the following-named officers were elected:

President, Mr. C. C. Perry, Indianapolis.

Vice-president, Mr. G. E. Varney, Danville.

Secretary-treasurer, Mr. Fred Leslie, Muncie.

Executive committee: Messrs. J. H. Harding, Laporte; L. E. Holderman, Terre Haute; W. B. McDonald, Evansville; J. P. Ohmer, Elkhart; R. W. Waite, New Albany.

Advisory committee: Messrs. T C. McReynolds, Kokomo; Thomas Taggart, French Lick; H. M. Case, Connersville.

Finance committee: Messrs. Fred B. Hofft, Indianapolis; J. N. Moncrieff, Bloomington; Clemens Blank, Martinsville.

In taking the chair, Mr. Perry thanked the members and said that he believed the association would prove of great benefit to the industry in the State. The members should act in concert for the common good. A vote of thanks was extended to the retiring president and to the secretary, and the convention stood adjourned.

Mr. C. C. Perry, the new president, is a prominent figure in the central-station industry. He has been engaged in electrical pursuits all his business life, and is now president of the Indianapolis Light & Heat Company, which he organized in 1888 and has developed to large proportions with 15,000 kw in station capacity and 16,000 meters on the circuits. Mr. Perry was born in Richmond, Ind., in 1857 and was a telegraph operator and superintendent for the Central Union Telephone Company at Fort Wayne before engaging in the light and power industry. He has the distinction of establishing the first commercial electrical plant in the State at Richmond in 1880. Since that time he has watched the development of the business and has been an active participant in it. He went to Indianapolis to engage in electrical manufacturing with the old Jenney Electric Company in 1885, and three years later he organized the central-station company which he still controls. He is vice-president of the Association of Edison Illuminating Companies. In Indianapolis he is, of course, very well known. He is a former president of the Board of Trade and of the Marion Club of that city. His strength and prestige should be important assets to the new State association.

CONVENTION NOTES.

No action was taken in reference to place of holding the next annual meeting. It has been suggested that French Lick be the regular meeting place for the Indiana conventions.

The entertainment consisted of taking the waters at French Lick, horseback riding, golf and dancing in the evening.

After the convention finally adjourned there was an informal after-meeting on Thursday afternoon at which Mr. E. E. F. Creighton, of the General Electric Company, went further into the subject of lightning protection for the benefit of all interested.

While the attendance of central-station men might have been larger, still it amounted to 60 per cent of the active membership—a good proportion.

Neat badges were provided for members and visitors. The button, of bronze, displayed Franklin's key and lightning flashes, surrounded by the words "Indiana Electric Light Association" in a circle. Above was a cross-bar with space for the wearer's name and beneath a small ribbon—purple for active members and light blue for associate members.

Public Service Commission Hearing on Meter Test Reports.

The Public Service Commission of the First District will hold a hearing at 2:30 p. m., on Aug. 30, at its office, 154 Nassau Street, New York, for the purpose of determining whether, in order to insure the reporting to the commission of all tests of electric meters according to a standard form of report, an order should be issued by the commission containing substantially the following provisions:

The contemplated regulations stipulate that all tests of electricity meters shall be made under actual operating conditions as regards voltage, frequency, temperature, stray fields and vibration. Where shunts, series transformers or shunt transformers are used in connection with meters, the latter shall be tested from the line side of such apparatus when the voltage does not exceed 600. If the tension exceeds 600 volts, the meter may be tested as a self-contained instrument and the ratio certificates of the transformers may be used in calculating the true line watts. When rotating standard meters are used the connections must be so arranged as to give the tester full control of the starting and stopping of the standard and at the same time allow him that he may count the revolutions of the meter under test.

Each meter must be tested independently and not while it is connected in series with one or more other meters unless the potential circuit of each meter is so arranged as not to be fed through the field of any meter under test or rotating standard.

Direct-reading indicating wattmeters shall be used as standard instruments in making tests of consumer's meters. The commission calls for tests at one-tenth normal and full load rating of meter, and the average of the three tests obtained by multiplying the result of the normal load test by 3, adding the results of the light and full-load tests and dividing the total by 5, shall be deemed the condition of the meter. This final average is required to be reported to the commission on a prescribed form.

If a meter is found to be connected to a load which takes a current varying not more than 5 per cent of the rating of the meter and consisting of one or more units which will furnish such a load regardless of its method of control, then such load shall be used as the normal and only load during the test of a complaint meter. Unless an actual examination of the consumer's installation and use shows an important variation from that given herewith, the following classification in percentage of installation shall be used in determining normal load: Residence and apartment lighting, 25 per cent; elevator service, 40 per cent; factories (individual drive), churches and offices, 45 per cent; factories (shaft drive), theaters, clubs, entrance, hallway, and general store lighting, 60 per cent; saloons, restaurants, pumps, air compressors, ice machines, etc., 70 per cent; sign and window lighting, blowers and moving-picture machines, 100 per cent.

If a meter is found to be connected to an installation consisting of two or more of the above classes of loads, the normal load must be obtained by taking the average. Three tests shall be run on each load at which the meter is tested and should any two fail to agree within 1 per cent, a fourth test shall be run and the average for that load shall be the average of the three tests agreeing with each other within the limits of 1 per cent.

The commission provides two forms, one for a meter tested as a result of a complaint, and the other for meters tested periodically.

Convention of the Michigan Electric Association.

The Michigan Electric Association held its sixth annual convention at Hotel Tuller, Detroit, Mich., Aug. 17, 18 and 19. The arrangement of the sessions was somewhat different from that ordinarily prevailing in State conventions of this kind. The first session was held Monday evening, the second session Tuesday morning, and the third session Thursday morning. This left Wednesday and Thursday afternoon open for the entertainments which the Detroit people had provided in unusual abundance. The first session was called to order at 8 o'clock Monday evening by President H. W. Hillman, of Grand Rapids. Mr. Hillman said that there has probably never been a time

when the association has given more attention to the subject of incandescent lamps. Therefore, this first session was to be devoted to tungsten lamps, which lamps, however, no longer seem to be new. The heating branch of the industry has likewise advanced since the last meeting. Considerable interest was shown at the last convention of the National Electric Light Association with regard to heating devices, and the heating committee of the Edison Association, which meets next month, will have some interesting features to report as to extension of electric-heating business. Electrochemical and electrometallurgical matters are now coming before central stations for discussion and handling. A few have had to supply energy for bleaching purposes. Information on this character of load for central stations cannot be found in the ordinary hand-books and literature. At the National convention several delegates brought up this subject, but so much attention was attached to the motor business that no time was available for bringing out the important features in connection with electrochemical work. For fear the Michigan association will make a similar mistake, Mr. Hillman recommended that the incoming president appoint a committee of three members to be known as the committee on electrochemical and electrometallurgical matters. At the last meeting in Grand Rapids many delegates expressed satisfaction with the tungsten arch lighting on Canal Street. During the 12 months past there have been upward of a dozen streets there illuminated in a similar manner by the merchants. Instead of the old arc lamps taking 7 kw per mile of street, the merchants have adopted a standard of 60 kw to 70 kw per mile. Individually and collectively merchants speak of the arch illumination on all the streets in the highest praise. New business of this kind is being continually closed. A year ago only one street was illuminated with the arch system, and it was more or less a trial for the observation and consideration of the merchants of that city.

To-day the system represents a practical, popular method of lighting pleasing to the public, capable of extension on all the streets of the business districts, and with an annual earning capacity of more than $10,000 for the power company. He feels that similar results can be secured in all the cities and towns in the State of Michigan. The situation as to electric motors is one which should be studied more than ever. At this meeting Mr. Hillman said unusual importance would be attached to the forcible presentation of the merits of curve-drawing wattmeters and their value in connection with electric motor drives. Experience would seem to indicate that the curve-drawing wattmeter is as important to the electric motor branch of the industry as illuminating engineering has proved to be in relation to the lighting field. Therefore, several papers would be read on the subject. He hoped that every member would give careful attention to this matter to the end that the stations of Michigan will have been first to benefit from the extensive use of curve-drawing wattmeters. To emphasize this subject still more fully, Mr. Hillman said that the watchword of this convention would be curve-drawing wattmeters.

The president appointed a nominating committee consisting of Messrs. F. T. Masterson, of Grand Rapids; O. S. Wood, of Ionia, and William Constable, of Grand Rapids.

ILLUMINATION SESSION.

The session of this evening was devoted to lamps and illumination. The first paper presented was by Mr. E. G. Berg, of the General Electric Company, on tungsten lamps. Another paper, on the same subject, was presented by Mr. B. F. Fisher, of the Westinghouse Electric & Manufacturing Company. Mr. F. T. Masterson, of the Grand Rapids-Muskegon Power Company read a short paper on the care of tungsten street lamps, reviewing the experience in Grand Rapids with the maintenance of the arch system so extensively used there. The tungsten lamp in the residence was the subject of a paper by Mr. John Vandervliet, of the Grand Rapids-Muskegon Power Company. Mr. J. R. Cravath gave a talk illustrated with blackboard sketches on the principles of efficient illumination. Mr. Fred T. Benson, of the General Electric Company, was then called upon and read extracts from letters of a number of central-station companies giving experiences as to the effect of the tungsten lamp on business. Mr. Benson read only a few letters, but stated that he had 50 along the same line. These all agreed as to the beneficial effect of the tungsten lamp on central-station business, and that it had enabled central stations to get business which heretofore was out of reach. Several noted reductions in revenue on some installations when tungsten lamps were first installed, but the consumer usually increased his consumption after a few months. Mr. W. J. Trott, of the Fostoria Incandescent Lamp Company, Grand Rapids, spoke briefly of the tungsten arches in use in Michigan cities, and also of a company organized in St. Louis for the purpose of cleaning and maintaining lamps and reflectors for electric light consumers. The discussion was participated in by Messrs. A. C. Marshall, of Port Huron; E. F. Phillips, of Detroit; Harry Fee, of Adrian, and others.

POWER SESSION.

The Tuesday morning session was devoted to the consideration of electric power, and especially to the advantages in the use of curve-drawing instruments placed on consumers' loads to indicate the hours during which electricity is used and the amount used at various times. Some papers were also devoted to descriptions of these instruments. A paper by Mr. M. S. Mead, chief engineer of the Brunswick-Balke-Collender Company, was read in his absence. This described the electric-motor installation in one of the largest wood-working plants in the country, which is that of Mr. Mead's company at Grand Rapids. Mr. Charles H. Scott, of the General Electric Company, Boston, gave a large number of facts and figures in a paper on power used in the re-manufacture of lumber, with special reference to electric power. He showed that wood-working plants use an important percentage of the total amount of power employed for manufacturing purposes in this country. In sawmills, where lumber is first turned out, there is usually not so much chance to get electric power as in wood-working establishments, which handle the lumber after it is manufactured and which have a smaller percentage of refuse to burn.

President H. W. Hillman then introduced the subject of curve-drawing wattmeters and said that there is a chance for the Michigan Electric Association to do some pioneer work in bringing about a recognition of the value of such instruments. Curve-drawing wattmeters give to the central station the much-sought opportunity to prove the superiority of electric-motor drive over steam. No such instrument as the curve-drawing wattmeter can be applied to steam-driven factories. Mr. W. B. Wreaks, of the Westinghouse Electric & Manufacturing Company, of Detroit, read a paper introducing the subject of curve-drawing wattmeters and their value in measuring consumers' demands. Mr. Paul MacGahan, of the Westinghouse Electric & Manufacturing Company, presented a paper illustrated with lantern slides, giving a full technical description of different available forms of curve-drawing wattmeters, including both the cheap types and the precision types. Another paper on curve-drawing instruments and some of their applications, which was written by Mr. J. M. Van Splunter, was read by Mr. Louis Friedmann. In discussion of this paper President Hillman gave some further experiences in which the record of a curve-drawing wattmeter on a lighting customer was very helpful in straightening out what would have otherwise been a complaint. Miss Sarah M. Sheridan, contract agent of the Detroit Electric Company, gave some Detroit experiences and practice with curve-drawing instruments, and her remarks were supplemented by Mr. B. J. Denman, also of Detroit. Mr. D. J. Fleming, of the Westinghouse Electric & Manufacturing Company, presented a paper illustrated with some lantern slides, in which records from several installations were presented.

As a result of the papers and discussions on curve-drawing instruments it appeared that the Detroit and Grand Rapids companies were the only ones which have used these instruments to any extent. Representatives of both companies were agreed on the desirability of having such instruments connected on consumers' loads wherever consumers could be induced to purchase them, as their records frequently revealed to the

consumer unforeseen chances for improvement in the operation of the plant, or in the economical use of electricity, and they show also the actual power taken by different machines.

HEATING SESSION.

Thursday morning all of the papers were devoted to electric heating. Mr. J. D. A. Cross, of the General Electric Company, of Chicago, presented a paper on the extension of the heating-device business. Mr. William Constable, chairman of the electric-heating committee of the association, presented a report of that committee, which consisted of Messrs. Wm. Constable, H. A. Mott and R. W. Hemphill, Jr. An abstract of the paper read before the National Electric Light Association by Mr. Charles J. Russell on heating devices for industrial purposes was given by Mr. H. W. Hillman. In the discussion on electric heating, Mr. H. J. Mauger, of the General Electric Company, said a few words as to the lines of development and improvement carried out by his company. Recent improvements make it possible to run heating elements at a much higher density in watts per square inch than was formerly possible and may considerably change future practice. Mr. William Constable called special attention to electric welding in various kinds of manufacture. Following the subject of electric heating, a paper on central-station advertising was read by Mr. J. O. Little, of the Westinghouse Electric & Manufacturing Company.

A vote of thanks was passed to the Detroit Edison Company, and especially to Messrs. E. F. Phillips and A. P. Biggs for the handsome entertainment provided for the convention. Mr. R. N. Hemphill presented a report of the finance committee

PRESIDENT A. C. MARSHALL.

which showed a cash balance over and above liabilities. Mr. F. T. Masterson presented the report of the nominating committee, which resulted in the election of the following officers:

President, Mr. A. C. Marshall, of Port Huron; vice-president, Mr. George B. Westover, of Cadillac; secretary and treasurer, Mr. A. P. Biggs, of Detroit; executive committee: Messrs. A. C. Marshall, of Port Huron; R. W. Hemphill, Jr., of Ann Arbor; A. Parshall, of Jackson; O. S. Wood, of Ionia, and William Loudon, of Traverse City; finance committee: Messrs. William Chandler, of Sault Ste. Marie; Harry Fee, of Adrian, and W. P. Hetherington, of Belding.

The new president, Mr. A. C. Marshall, took the chair and a vote of thanks to retiring President Hillman for his services the past two years was unanimously passed.

The registration at the convention was between 200 and 300. Entertainment was lavishly provided by the Detroit central-station people and manufacturing interest. Wednesday morning an automobile trip was given to the ladies over the beautiful parks, boulevards and streets of Detroit. Wednesday afternoon the whole convention was taken by special cars to the American League ball park to witness the game between the Detroit and Chicago clubs. In the evening all attended a vaudeville entertainment at the Temple Theater. Thursday afternoon a special boat was chartered for a trip down the Detroit River, which was both interesting and enjoyable. Several engineering works of great interest are being carried out in the Detroit River at present. One of these is the sinking of the concrete sections of the Michigan Central tunnel, and another is the Livingstone cut which is to create a new channel through the shallowest part of the Detroit River. Much of this cut is through solid rock, and the work is being carried out "in the dry" by building coffer dams around the section to be excavated. After visiting the work at this cut the boat went on down the river to Lake Erie and returned to Bois Blanc Island for supper. The boat then returned to Detroit, reaching there about 10 p. m.

Mr. A. C. Marshall, president-elect of the association, was born in 1872 at Middletown, Ohio, but was brought up and has spent most of his life in the vicinity of Detroit. He is a graduate of the Detroit high schools, and took the electrical engineering course at the University of Michigan, at Ann Arbor, from which he was graduated in 1893. At the time of his graduation Mr. Alex Dow was building the municipal street lighting plant of Detroit, and Mr. Marshall occupied various positions under Mr. Dow during the construction of that plant. He remained with the plant in various operating positions, including that of assistant city electrician until 1899. That year he became electrical engineer during the construction of the Rapid Railway from Detroit to Port Huron, which was the first interurban road to employ high-tension transmission out of Detroit. When this road began operation he continued with the company as chief engineer, having charge of power plant, line and shops. After the consolidation of the Rapid Railway with the Detroit United Railway he entered the employ of the Detroit Edison Company in various engineering capacities for one year. In 1905, when the control of the Port Huron Light & Power Company passed under the control of the Detroit Edison interests, Mr. Marshall became general manager of the Port Huron company. He has been secretary of the Michigan Electric Association since its organization in 1905 and so has been closely identified with its progress.

Mr. A. P. Biggs, the secretary-elect, amply demonstrated his ability to get results by the way he carried out the details of the entertainment program, and an efficient administration seems assured.

Abstracts of the papers and discussions presented at this convention will be printed in later issues.

CURRENT NEWS AND NOTES.

WINNIPEG MUNICIPAL PLANT.—According to a statement made to the City Council by the power committee, the municipal power plant now being constructed by the city of Winnipeg at a cost of $3,500,000, will be in operation by 1912.

MANITOBA TELEPHONE ORGANIZATION.—The Manitoba Government Telephone Commission has decided to divide the Province into districts, each of which will be under the direct charge of a manager. Each district will be managed under three heads—commercial agent, superintendent of plant and superintendent of service. The new system goes into effect on Sept. 1.

CONVENTION SOUVENIRS.—The American Street and Inturban Railway Manufacturers' Association has notified its members that the practice of distributing souvenirs at conventions has become objectionable to a majority of members, that the practice should be discouraged, and that the matter should be taken up for disposition at the next annual meeting of the association.

ELECTRIC TRACTION IN PARIS.—Sixty-two electric railway lines are operated in Paris or radiate therefrom, which are owned by five companies. The annual average of passengers carried is 190,000,000. The fare inside the fortifications is generally 6 cents for inside and 3 cents for the upper deck. The total mileage of all lines is 12,348, the average annual receipts being $5,146,538.

CONVERSING 155 MILES BY WIRELESS TELEPHONE.—According to a cable despatch from Toulon, France, wireless telephone conversation was carried on between Toulon and Port Vendres, a distance of 155 miles, on Aug. 1. The instruments used are the invention of Lieutenants Jeance and Colin, of the French navy.

VERMONT ELECTRICAL ASSOCIATION.—The annual convention of the Vermont Electrical Association will be held at Burlington, Sept. 15 and 16. The first day will be devoted to a business session and the reading and discussion of papers, and the second day to a boat trip on Lake Champlain with luncheon at Hotel Champlain, Bluff Point.

MARINE MAGNETIC SURVEYS.—The new non-magnetic yacht *Carnegie*, recently finished, left the shipyard where it was built last week, and after final tests of its machinery will sail north in order to commence a series of magnetic surveys. It will skirt the Labrador coast, and then enter Hudson Bay, where the work of determining the various terrestrial magnetic constants will be continued.

INCREASE OF TELEGRAPH RATES.—The Western Union and Postal Telegraph companies have announced a new schedule for cipher messages, to go into effect Sept. 1. Cipher messages will be charged at the rate of five letters to the word instead of 10 letters, unless the telegram consists of words which appear in the dictionary. Domestic messages are only affected by the new rule.

SIGNAL CORPS ELECTRICAL ASSISTANT WANTED.—The United States Civil Service Commission will hold an examination Sept. 29 to fill two or more vacancies in the position of electrical assistant in the Signal Service at Large, at $1,080 per annum, and provide for similar future vacancies. A circular as to qualifications, etc., may be obtained from the Washington office of the commission.

OLD-TIME TELEGRAPHERS.—The annual joint convention of the Old-Time Telegraphers' Association and the Society of the United States Military Telegraph Corps was held in Pittsburgh last week, beginning Aug. 17. The old officers were re-elected as follows: President, Col. Wilson; vice-presidents, Messrs. W. L. Ives and C. A. Tinker, of New York; secretary and treasurer, David Homer Bates.

GLACE BAY WIRELESS PLANT BURNED.—The main Marconi wireless station at Glace Bay, Nova Scotia, was destroyed by fire on Aug. 21, but the power house was uninjured. The building destroyed contained the operating and condenser rooms and a quantity of valuable machinery and apparatus. While wireless communication to Europe is interrupted, the usual wireless service to and from steamers off the coast will be maintained.

SUMMER MEETING OF NEW ENGLAND N. E. L. A. SECTION.—The first summer meeting of the New England Section of the National Electric Light Association will be held at Wentworth Hotel, Newcastle (Portsmouth), N. H., on Thursday and Friday, Sept. 9 and 10. An interesting and instructive program is being arranged, including papers on the latest developments of electricity, and entertainment of members and guests. Mr. C. H. Hodskinson, Boston, is secretary of the section.

PARIS TO NEW YORK BY WIRELESS.—A newspaper report recently published that the Eiffel Tower wireless station was in daily communication with New York is pronounced ridiculous by the wireless telegraph companies operating stations in this country. The installation on the tower was put in by the French Government, and is largely of an experimental nature. If any American station has ever picked up a message from the Eiffel Tower the matter has not been reported to the wireless companies.

ELECTRIC DRIVE FOR WAR VESSELS.—It is reported that Prof. Reginald A. Fessenden has recently submitted a proposition to the Navy Department for the equipment, experimentally, of a war vessel with turbo-electric drive. Professor Fessenden's plan is to use steam turbine three-phase generators, with induction motors on the propeller shafts. He claims that higher power can be obtained with less weight under this system than any other. The Navy Department has as yet made no decision as to whether it will make the experiment.

EDISON CONVENTION.—The thirtieth convention of the Association of Edison Illuminating Companies will be held at Briarcliff Lodge, Scarborough-on-the-Hudson, during the coming week, as already announced. An excellent program has been provided, but, as usual, the meetings will not be open to the public. A very large attendance of members is already registered and special interest is given to the occasion by the dinner to Mr. and Mrs. Edison on Sept. 2, commemorative of the thirtieth anniversary of the incandescent lamp. To this function a number of pioneer associates of Mr. Edison have also been invited. The week will thus be an eventful one in the annals of this body, which is composed of Edison lighting licensee companies.

A. I. E. E.—Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, left New York on Aug. 18 to attend as its delegate the Conservation Congress at Seattle, his two colleagues being Messrs. John C. Hays and J. Harisberger. He will also participate in the convention of the Northwestern Electric Light and Power Association. He will then visit the various Institute branches and sections on the Coast and attend the Denver street-railway convention for the Institute in October on his way home. It is worthy of mention that Mr. Pope is one of the distinctive Alaskan pioneers, being an active member of the Western Union Telegraph expedition in the early sixties to build a land line to Europe across Alaska and Siberia, just before the Atlantic cable became a success.

NEWFOUNDLAND CABLE CONTROVERSY.—The Anglo-American Telegraph Company has announced its support of the contention of the Newfoundland Government in its revocation of an agreement with the Commercial Cable Company as to certain privileges which had been granted to it by the Newfoundland Government. In a statement, General Manager Geo. C. Ward, of the Commercial Cable Company, stated that his company sought to fight its battle directly with the Premier of Newfoundland, and resents the entry of the Anglo-American Telegraph Company in the controversy. He says that the issue is whether the Newfoundland Government has the right to repudiate a legal and reasonable agreement, on the faith of which over $1,000,000 has been expended by an American corporation.

MONTREAL ELECTRIC ICE PLANT.—The Light, Heat & Power Company, of Montreal, Que., has announced that it would engage in the ice business. This end will be accomplished by obtaining water from artesian wells and freezing it by electric power. In addition to being absolutely free from garbage, dirt, etc., it could be turned out in any shape desired, which would obviate the necessity of the icemen cutting it on delivery. Such a plant as the company proposes to install will cost between $125,000 and $150,000, and commercial ice could be sold at a much lower price than at present. It is understood that a similar scheme has been proposed to the directors of the Winnipeg Electric Company, at Winnipeg, Man., where the river from which the ice harvest is obtained is not of the purest. In the latter city power is as cheap as in any Canadian city and ice is as dear as anywhere despite the cold winters.

Hydro-Electric Generating Station of the Great Western Power Company on the Feather River.

EIGHTEEN miles above the city of Oroville, Cal., the North Fork of the Feather River makes a big bend in the Sierras, and after winding through mile after mile of ravine and canyon, the river comes back to a point within three miles of where the bend starts. This section is known as Big Bend, and here it was that some years ago a mining company headed by Dr. Pierce, of patent medicine fame, drove a tunnel two miles in length, intended to divert the water through the mountain and leave the bed of the river around the bend dry, whence

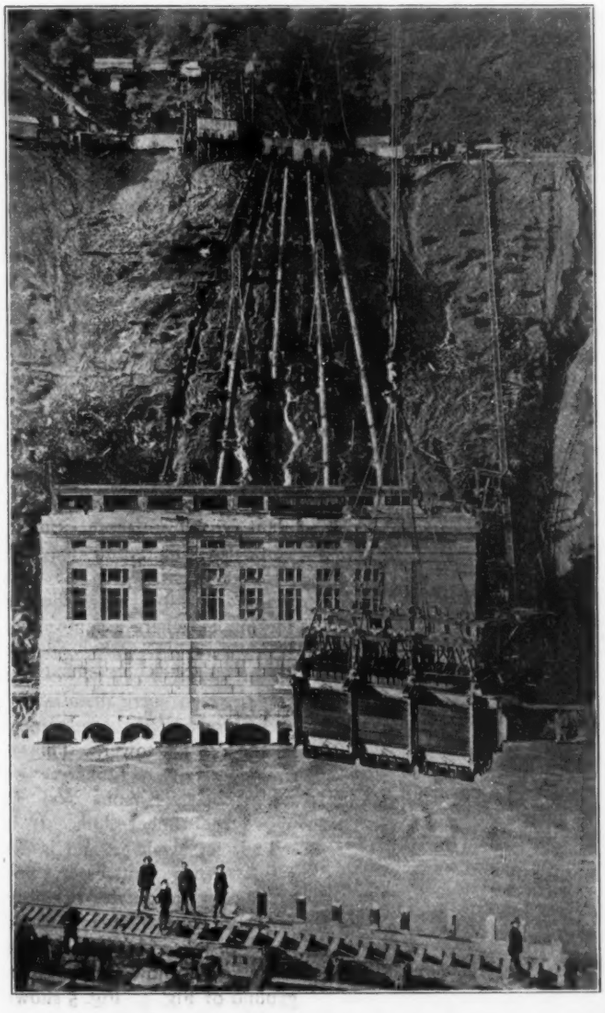


FIG. 1.—VIEW OF GREAT WESTERN POWER STATION FROM OPPOSITE BANK OF THE FEATHER RIVER.

the gold which it was said to contain could be easily secured. The Great Western Power Company acquired the tunnel from the Big Bend Tunnel & Mining Company, enlarging it and utilizing the drop for the manufacture of electricity on a large scale.

The initial development provides for diverting the water from the North Fork of the Feather River at the upper end of Big Bend through a tunnel 15,000 ft. long to a point in the hillside above the power house, from which point the water is carried through steel feeder pipes 450 ft. long to hydraulic turbo-generators, the present effective head being about 425 ft. A timber dam was constructed for diverting the flow of the stream through the tunnel, and the latter was enlarged so as to have a capacity of 2500 second-ft. flow, and lined with concrete. The company excavated and lined with concrete a new tunnel 3450 ft. long from a point near the end of the old tunnel to the point of discharge above the power house. At the outlet of the tunnel, the necessary header pipes, surge pipes, valves, gates, etc., for regulating and controlling the flow of the

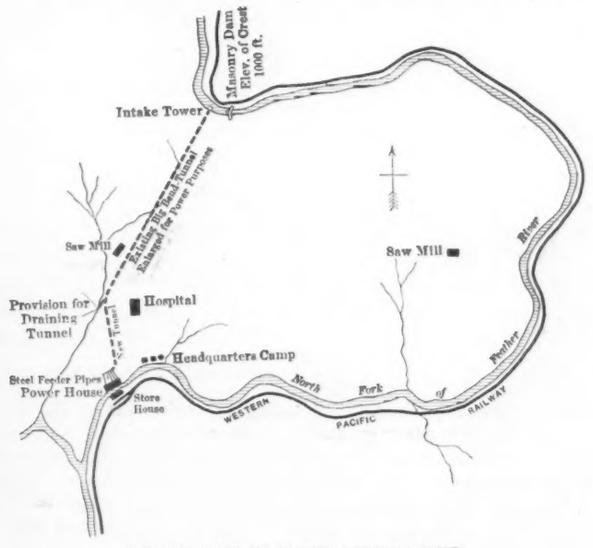


FIG. 2.—MAP OF POWER DEVELOPMENT.

water were constructed, with steel feeder pipes leading from the header to the turbines. The power house, which is constructed of concrete and steel, contains an initial installation of 40,000 kw. Leading from it are duplicate 100,000-volt lines on steel towers leading to Oroville, Marysville, Sacramento, Oakland and other points, the maximum transmitting distance being 165 miles. In connection with the transmission circuits substations are erected at Brighton (Sacramento), Antioch, Cowell and a terminal station at Oakland. In addition to the terminal station at Oakland there has also been erected a steam auxiliary station. From Oakland it is intended to transmit electrical energy to San Francisco, across the bay.

In designing the tunnels, intake tower, headers, pipes, etc., or, in other words, the complete hydraulic construction, it was with a view to utilizing the full flow of the river so that the dimensions are such as will permit of an ultimate generation of 120,000 hp in the power house. The additional units can be installed without in any way interfering with the operation of

FIG. 3.—CONCRETE INTAKE TOWER AND TIMBER DAM ON FEATHER RIVER.

the plant. Feeder pipes are now provided for four 18,000-hp turbines and connections with the header for four more.

Prior to beginning work on the development, it was necessary to open 20 miles of new roads, build bridges, etc. This preliminary work was completed seven months after it was

begun, or in April, 1907. Two steam compressor plants were built for construction purposes, two sawmills, living accommodations for 1100 men, etc. The nearest railroad station when the work began was that of the Southern Pacific at Oroville, and, owing to the rough character of the country, considerable difficulty was experienced in teaming from Oroville to the site. The line of the Western Pacific Railroad was pushed through the canyon and opened in February, 1908, to a point opposite the power house. The railroad was finished in time to make delivery of heavy machinery to the power house over it, a Lidgerwood cable hoist being used to transport the material to the opposite shore. Two steel towers 1200 ft. apart were connected by two 2¼-in. steel cables, over which a load of 35 tons could be transported from the railroad to the power house, and a load of 10 tons up the hill to the header pipe.

The main branch of the Feather River rises in Nevada, and in summer the flow of water is small, while in winter it is quite large. The North Fork rises in the Big Meadows, at Prattville, Cal., where the company plans to erect a massive storage reservoir, flooding 40 sq. miles and impounding 47,000,000,000 cu. ft. of water. By means of this reservoir the ordinary low-water flow of the river at the station, which is 1000 cu. ft. per second, can be made 1800 cu. ft. per second as a minimum. The Big Meadows abound with springs and rocks of volcanic origin which are porous and hold the water. From July to November, however, there is no rain in California, and it is during these five months that the water will be drawn from the reservoir. The maximum flow of the Feather River is 125,000 cu. ft. per second, at which times the river carries much silt, but is otherwise free from debris.

The crest of the timber dam thrown across the river has an elevation of 896 ft. above tidewater, and the water in the tailrace at low stages in the river is at an elevation of 456 ft. above the sea. The available head at the waterwheels is 428 ft., there being a loss of 12 ft. due to friction in the tunnel, etc. The river below the tailrace is quite open and the descent to Oroville quite rapid, so that there is no danger of backwater at any time. There is very little level ground throughout the canyon, as will be observed from the illustrations. Indeed, the chief difficulty encountered in the work was to find level spots for the camps and for storing material. This rendered construction difficult. The company was able to purchase 300 hp from the electric light company in Oroville, and in addition had about 700 hp in locomotive-type boilers. Cord wood was used for fuel at first until all the cord wood in the district was burned up, when recourse was had to fuel oil brought over the lines of the Western Pacific Railroad. A camp was erected at about the middle point of the tunnel, where a compressor plant, machine shop, crusher, concrete mixer and lodgings for 600 men were provided. Another camp was pitched at the intake, where a compressor plant, crusher and concrete mixer, together with dwellings for 400 men, were installed.

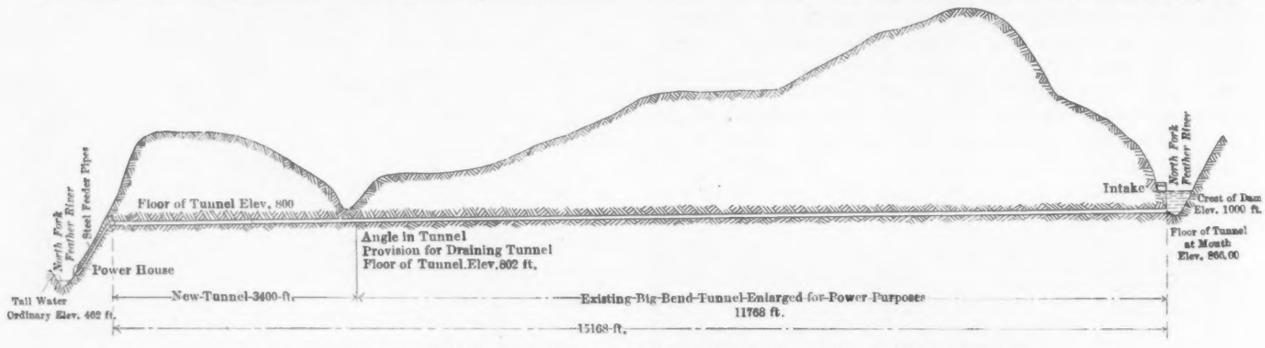

North Fork Feather River Steel Feeder Pipes
Floor of Tunnel Elev. 800
Power House
Tail Water Ordinary Elev. 462 ft.
Angle in Tunnel
Provision for Draining Tunnel
Floor of Tunnel Elev. 802 ft.
Intake
North Fork Feather River
Crest of Dam Elev. 1000 ft.
Floor of Tunnel at Mouth Elev. 866.00
New Tunnel 3400 ft.
Existing Big Bend Tunnel Enlarged for Power Purposes
11768 ft.
15168 ft.

FIG. 4.—CROSS-SECTIONAL ELEVATION OF MOUNTAIN AT BIG BEND SHOWING TUNNEL.

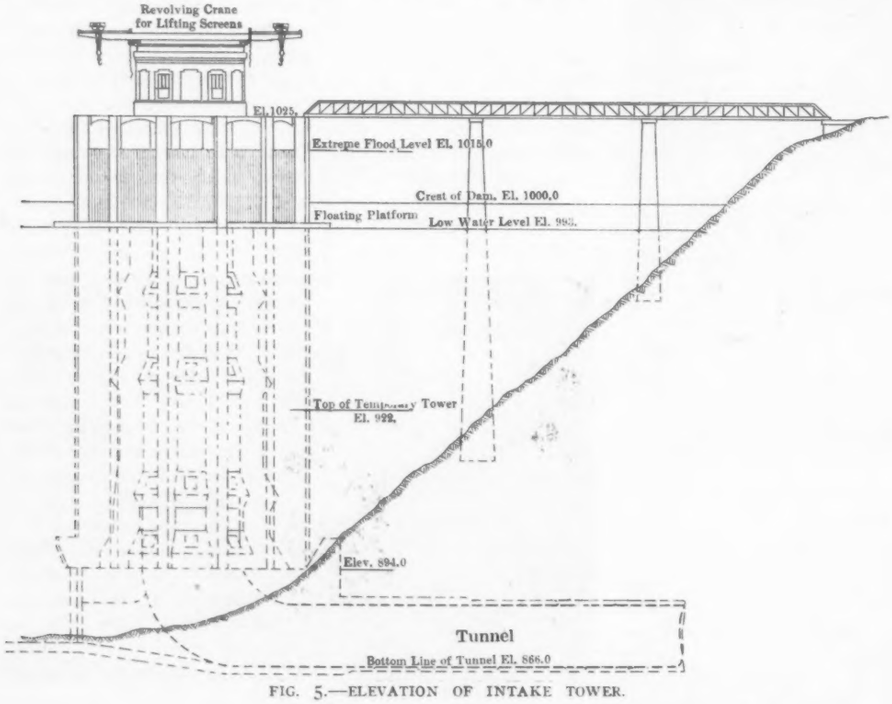


FIG. 5.—ELEVATION OF INTAKE TOWER.

A feature of the development is the intake tower. This is built entirely of concrete on rock bottom, about 600 ft. above the timber dam. It is cylindrical in shape and is designed with buttresses and guides for racks with openings at four levels. It is located some distance from the river bank, and is shown in the background of Fig. 3. Fig. 5 shows an elevation of the tower as it will appear when completed. At present there are 24 3-ft. 3-in. x 4-ft. openings and four 5-ft. x 12-ft. 3-in. openings provided with gates having a tendency to shut themselves so that head-gate troubles will be avoided. By means of the tower clean water and large gate openings are assured. It is also possible by this means to shut off water from the tunnel and make the tunnel accessible from the tower end. The water enters the tunnel at the bottom of the tower, as shown, and the craneway is used for lifting the screens and gates. The latter are lifted electrically, and, as just pointed out, close without the application of any power whatever. The top of the finished portion of the tower is at present 922 ft. above the sea. When the work is entirely

completed, the timber dam will be replaced by one of masonry, whose crest will be 1000 ft. above tidewater.

The old tunnel has a grade of one-half of 1 per cent, and the newer section has a grade of 1 ft. in 3000 ft. As will be seen from the profile of the tunnel, the drop is slight. The tunnel is bored through rock its entire length and is lined with concrete 21 in. thick. The net cross-sectional area of the tunnel is 220 sq. ft., and it was designed for a maximum pressure of 87 lb. per square inch. A view of the tunnel is given in Fig. 4, and Fig. 12 is a view of the end connecting with the feeder pipe. The latter pipe extends into the tunnel 125 ft.

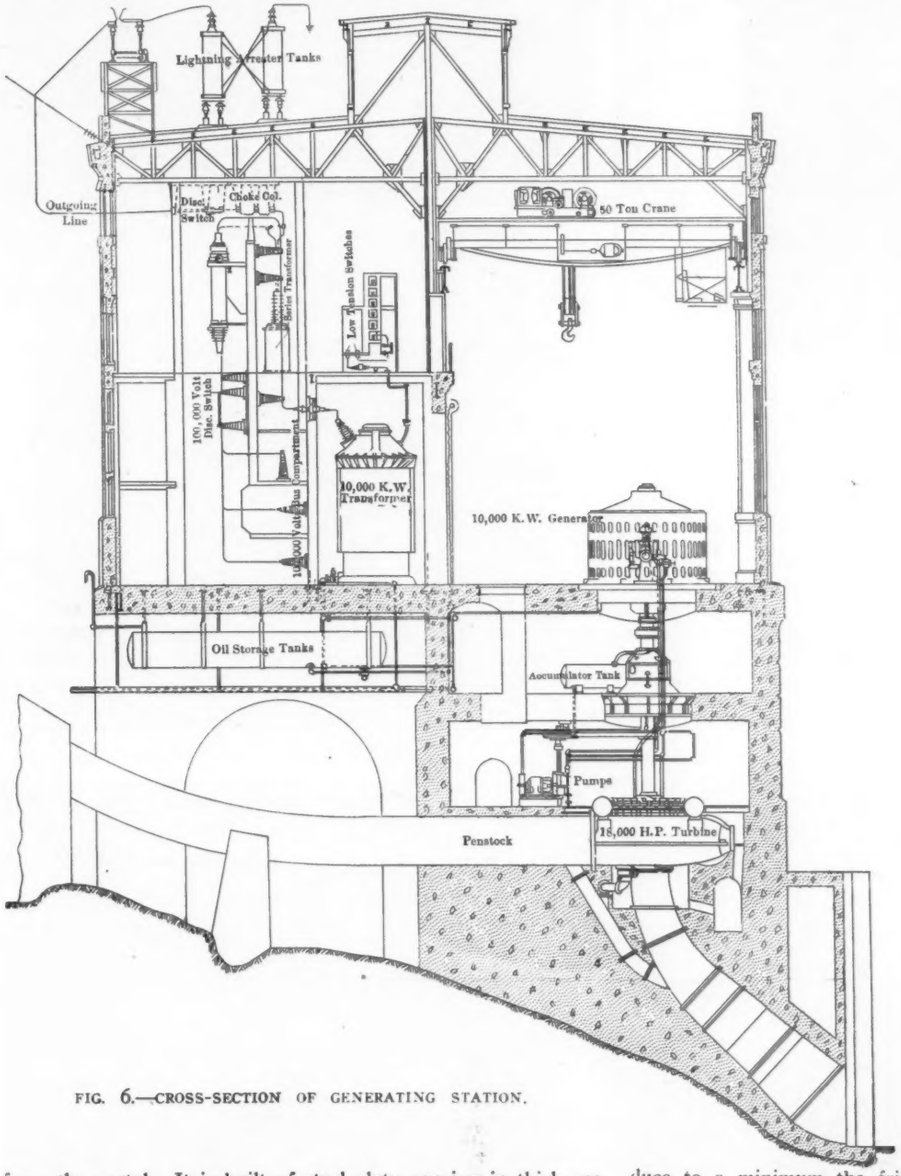


FIG. 6.—CROSS-SECTION OF GENERATING STATION.

from the portal. It is built of steel plate varying in thickness from 1 in. to ½ in. and has an inside diameter of 16 ft. 9 in. tapering to 9 ft., as shown in Fig. 8, and connecting with a surge pipe 9 ft. in diameter. The surge pipe is 302 ft. long and continues up hill to an elevation of 940 ft. and empties into a concrete spillway chamber, whence the water escapes to the river.

The penstocks are 5 ft. in diameter except those for the exciter sets, which are 2 ft. in diameter, and are built of steel imported from Germany and varying in thickness from 17 mm to 10 mm. The penstocks are the largest yet built for the pressure used. Air and butterfly valves are provided at the top of the penstock, the latter operated by hand, and the gate valves are operated by direct-current motors controlled from the switchboard. The valves and gates are shown in Fig. 10. No gates are provided at the power house end of the large penstocks except the gates in the wheels. Gates are fitted to the penstocks feeding the exciter turbines.

The generating station is 71 ft. 4 in. wide and 183 ft. 6 in. long and houses the following equipment: Four 18,000-hp reaction turbines, direct-connected to as many 10,000-kw, 11,000-volt, 60-cycle, three-phase, vertical-type alternators; two 500-hp impulse wheels, direct-connected to 250-kw, 250-volt, horizontal, direct-current generators; four 10,000-kw, three-phase, water-cooled, oil-insulated, 11,000-volt to 100,000-volt, delta-connected transformers. Each of the latter, with oil, weighs over 200,000 lb., and the core alone weighs 35 tons. The arrangement of the equipment is well shown in Fig. 6, which is a cross-sectional elevation of the station.

Especial interest centers in the generating equipment because of its size. The turbine wheels were designed and built by the I. P. Morris Company, of Philadelphia, and are of the vertical-shaft, inward-flow Francis type, operating at a speed of 400 r.p.m. under an ultimate head of 525 ft. The runner operates in a cast-steel volute casing. Each unit consists of bronze runner and cast-steel guide vanes, steel shaft, cast-iron draft tube, cast-steel volute casing, guide bearings, oil-disk thrust bearings, double floating-lever governor, oil pumps and auxiliaries. The turbines are the highest powered wheels in the world and are applied to a higher head than has been the custom for reaction turbines. Only a few years ago a head of 300 ft. was considered the upper limit for a wheel of this type. The turbines are operated without relief valves and the casings are made strong enough to withstand the increase in pressure due to the closing of the gates at a higher speed than the operating cylinders are designed to give. The runner of each unit is cast in one piece, the cores being fitted so as to insure uniform thickness of metal, and the vane surfaces made smooth so as to reduce to a minimum the frictional losses. The water is distributed to the runner by cast-steel movable guide vanes. Each vane has cast with it a shank which extends through the stuffing boxes in the head cover and is connected at its outer end through a lever and link to the operating ring. The latter is controlled by two hydraulic cylinders mounted on the wheel casing. These cylinders are controlled by the double floating-lever governor.

The volute casing is 5 ft. in diameter at the intake and it is split by a vertical plane passing through the axis of the shaft. The halves are bolted together on a vertical flange. A babbitt-lined guide bearing is situated directly above the runner and incorporated in the head cover. The weight of the revolving parts of the turbine (25,500 lb.) and the weight of the rotor

of the generator (119,500 lb.), or a total weight of 145,000 lb., is carried by an oil-disk thrust bearing. This bearing con-

FIG. 7.—INTERIOR VIEW OF INTAKE TOWER.

sists of two disks, the lower one stationary and the upper one revolving with the shaft. Between the two disks is an annu-

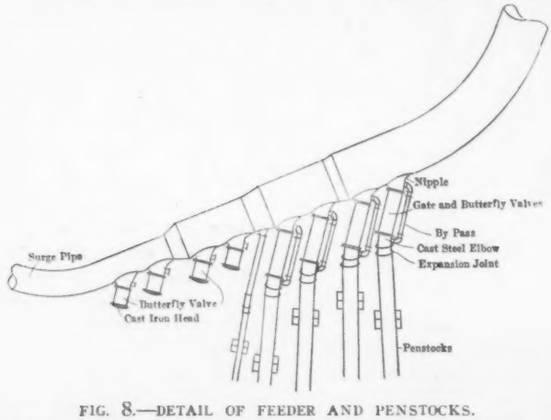


FIG. 8.—DETAIL OF FEEDER AND PENSTOCKS.

lar chamber into which oil is forced at a pressure of about 250 lb. per square inch. The weights of the revolving parts are,

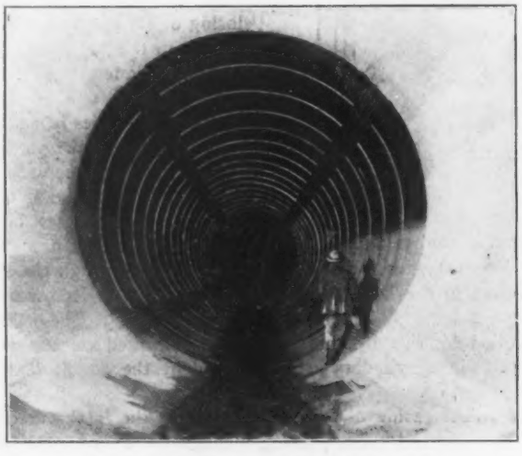


FIG. 9.—INTERIOR VIEW OF FEEDER PIPE.

therefore, carried on a film of oil at high pressure. Oil is supplied to the thrust bearing by an I. P. Morris Company's horizontal triple pump, which is driven by belt and gearing from the turbine shaft. Oil is supplied to the governor by a duplicate of the thrust-bearing pump, driven by a direct-current motor. The oil on its way to the governor passes through an accumu-

FIG. 10.—MOTOR-DRIVEN PENSTOCK VALVES.

lator tank, the function of which is to maintain a steady and uniform pressure for the oil supplied to the governor. The

FIG. 11.—OUTLET CHAMBER AT TOP OF SURGE PIPE.

contents of this tank are maintained at one-quarter oil and three-quarter air and at a pressure of about 250 lb. per square

FIG. 12.—INTERIOR VIEW OF TUNNEL THROUGH MOUNTAIN.

inch, the same as in the thrust bearing. This is accomplished by means of a quantity regulator which is placed in the discharge pipe line to the governor pump. When the load on the turbine is fairly constant and no oil passes to the governor, the

pressure on both sides of the regulator is equalized and the oil from the governor pump is discharged through a relief valve into the thrust bearing. In this way the thrust bearing acts as an automatic relief for the whole system. Both the pumps take their suction from a large plate-steel storage tank holding 100 cu. ft. placed beneath the floor. The returned oil from the governor and thrust bearing is discharged into this tank. The oil is cooled by coils of wrought-iron pipe through which water from the turbine casing is circulated. All piping and valves used for oil in connection with the thrust bearing and governor are of brass.

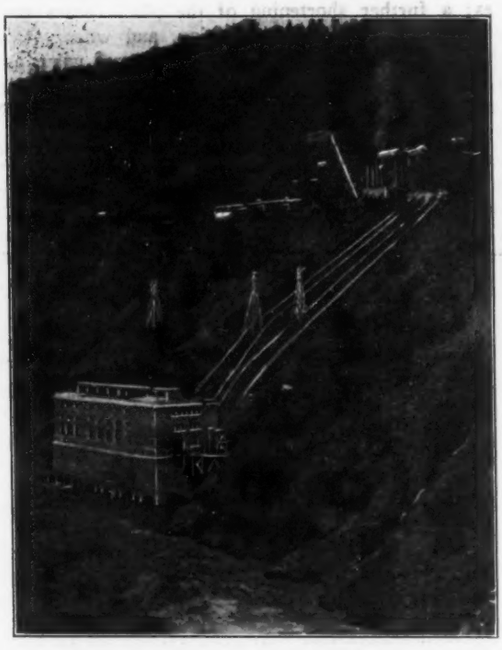


FIG. 13.—VIEW OF STATION SHOWING PENSTOCKS AND SURGE PIPE.

The governor and controlling valve are located on the generator-room floor some 24 ft. above the turbine floor and connected by piping to the two operating cylinders located on the turbine directly below. Should the governor be out of commission, the wheel may be operated by a small hand wheel controlling a valve placed on top of one of the operating cylinders. Again, should the oil supply fail, the wheel may be operated by this same valve, using water from the wheel casing in one cylinder only. One cylinder gives sufficient power to open and close the gates, but the power is insufficient to regulate the water turbines properly. The efficiency tests of these units have not as yet been made, but the guarantees are as follows: Full load, 80 per cent; three-quarter load, 82 per cent; one-half load, 76 per cent for heads ranging from 460 ft. to 525 ft. and with a constant speed at all heads. Fig. 14 shows one of the units assembled in the shop of the builder, but does not show the shaft. In the condition shown the wheel casing was put under a severe hydrostatic test to insure that the steel castings were perfectly sound and all points tight.

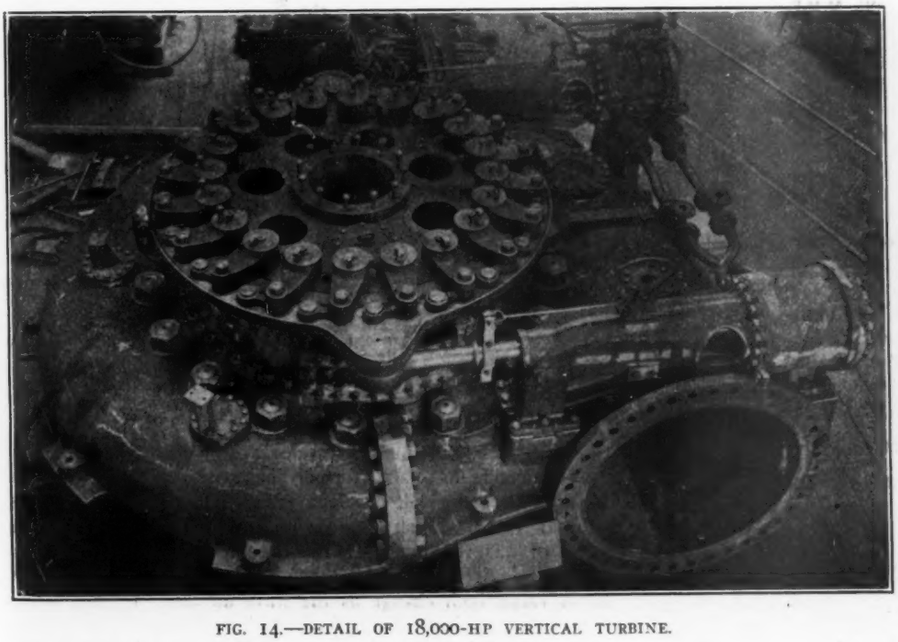


FIG. 14.—DETAIL OF 18,000-HP VERTICAL TURBINE.

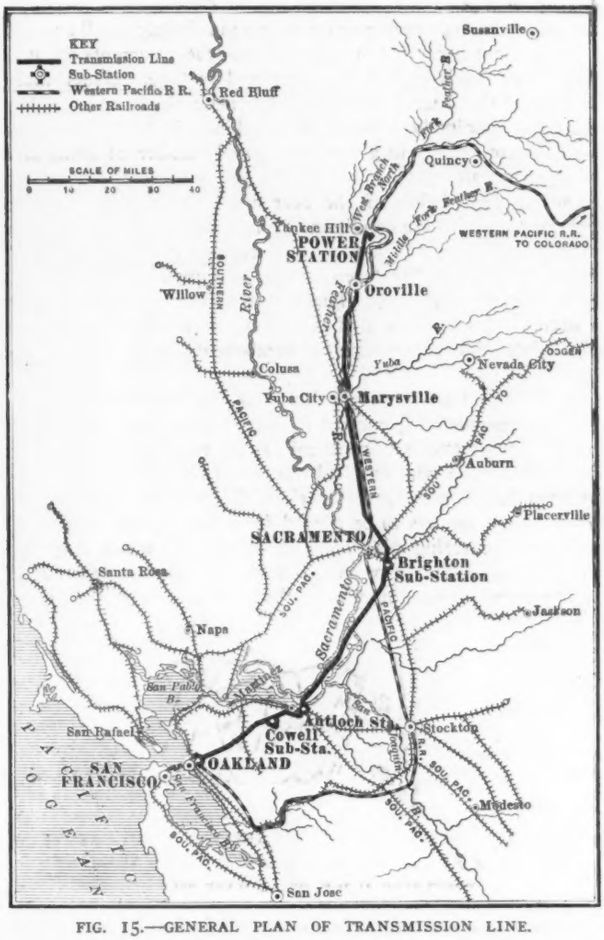


FIG. 15.—GENERAL PLAN OF TRANSMISSION LINE.

Like the water turbines, the electric generators, transformers, etc., are characterized because of their size, being among the largest ever built. A feature of unusual interest is the employment of 100,000-volt pneumatically operated oil switches on the outgoing high-tension lines. This is the first installation of switches of this type made.

The details of the electric equipment and other features of this development will be taken up in a subsequent issue.

Polyphase Magnetomotive Forces.

By J. D. Nies.

IN an ideal polyphase apparatus the winding is laid into an indefinitely large number of slots, an indefinitely small amount of current is carried in each slot, and these currents are distributed sinusoidally, both in space and in time. Under these conditions the m.m.f. and the magnetic flux are also distributed sinusoidally. In actual machines it is necessary to mass the conductors in a relatively small number of slots, and to use a small number of phases and consequently a non-sinusoidal distribution of the currents. The m.m.f. and flux developed under these conditions deviate more or less from sine space distribution, and assume an irregular distribution represented by the familiar "step curves"—examples of which are given in every text-book. The object of the present article is to derive rules by means of which any step curve can be resolved into sine components, a fundamental and higher harmonics.

These rules lead to simple formulas for calculating counter e.m.f. and magnetizing current in induction motors. There are already many methods in practical use for making these calculations, but anyone who has had occasion to compare them cannot have failed to note that serious differences exist between them. There appears to be a need for rules capable of general application, covering all kinds of windings, which can be used not only in induction-motor work, but also for calculating the armature reaction m.m.f. in alternators, rotary converters

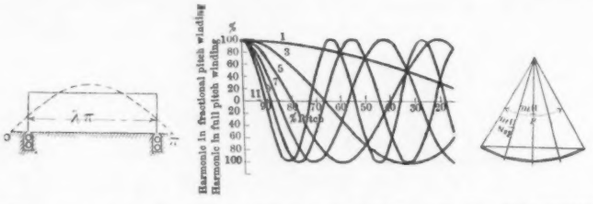


FIG. 1.—M.M.F. OF A COIL WITH ONE TURN. FIG. 2.—HARMONICS IN THE M.M.F. OF FRACTIONAL PITCH COILS. FIG. 3.—RESULTING M.M.F. OF A PHASE BELT.

and even direct-current machines where it is desired to separate the total m.m.f. into fundamental and harmonic components

ANALYSIS OF SINGLE-COIL M.M.F.

The m.m.f. of a single coil of fractional pitch λ is represented in Fig. 1, the limits of the pole arc being 0 and π. This m.m.f. is the same at all points within the spread of the coil, but varies with the time in accordance with the law of variation of the current in the coil, and has for a current of sinusoidal wave form the maximum value

$$\sqrt{2}\, I\, n_c$$

where I = effective amperes per circuit in the winding.

n_c = turns per coil, or half the turns per coil in consequent pole windings.

The rectangle in Fig. 1 is composed of a fundamental sine curve and a series of odd harmonics. In order to combine conveniently the m.m.f. of this coil with that of the others in the same belt it is necessary to find the values of these components. This is easily done by multiplying by the m^{th} harmonic unit sine analyzer, $\sin mx_s$—where x_s is the angle measured from 0 in Fig. 1—then integrating between the limits $\frac{\pi}{2}(1-\lambda)$ and $\frac{\pi}{2}(1+\lambda)$, and multiplying by 2. This operation gives as the maximum of the fundamental component of Fig. 1 the expression

$$\frac{4\sqrt{2}}{\pi} I\, n_c \sin\frac{\lambda\pi}{2} \qquad (1)$$

and the maximum value of the m^{th} harmonic component

$$\frac{4\sqrt{2}}{m\pi} I\, n_c \sin\frac{m\pi}{2} \sin\frac{m\lambda\pi}{2} \qquad (2)$$

The fundamental component of the single coil m.m.f. is drawn in dotted line in Fig. 1.

In a fractional-pitch winding the harmonics are usually smaller than in a full-pitch winding. In a full-pitch winding the quantity $m\lambda$ is always equal to an odd number. If the pitch is shortened until $m\lambda$ = an even number, the harmonic vanishes; a further shortening of the pitch causes the harmonic to reappear with reversed sign, and when $m\lambda$ = next lower odd number the harmonic has the same value as in a full-pitch winding, but with opposite sign. For example, the third harmonic vanishes in a winding of 0.666 pitch, and reappears with full value (negative) in a winding of 0.333 pitch. The changes in the harmonics due to changes in the pitch are shown in Fig. 2 for the harmonics up to the eleventh expressed as fractions of the values which they have in a full-pitch winding. It is evident that by the choice of a suitable pitch it is possible to suppress any particular harmonic or bring about a considerable reduction of the more important ones.

RESULTANT M.M.F. OF A PHASE BELT.

Usually the conductors of each phase winding of a polyphase machine are distributed among several slots, each group of coils constituting a "phase belt." The coils of a phase belt are always connected in series, and therefore there is no time-phase difference between their m.m.fs.; there is, however, a space-phase difference between the m.m.fs. due to the overlapping of the coils, and, therefore, the total m.m.f. of a phase belt must be found by vector addition instead of arithmetical addition. The notation used here is adapted from a paper by Prof. C. A. Adams, read before the A. I. E. E. in June, 1908:

Let N_{sp} = slots per pole.

p' = phase belts per pole.

The single-coil m.m.fs. and their resultant are shown in Fig. 3, drawn for the m^{th} harmonic. With unit radius the length of a single chord

$$= 2 \sin\frac{m\pi}{2N_{sp}}$$

and the length of the resultant chord

$$= 2 \sin\frac{m\pi}{2p'}$$

$$\frac{\text{Resultant}}{\text{Single}} = \frac{\sin\frac{m\pi}{2p'}}{\sin\frac{m\pi}{2N_{sp}}} \qquad (3)$$

For the fundamental, letting $m = 1$, this becomes

$$\frac{\text{Resultant}}{\text{Single}} = \frac{\sin\frac{\pi}{2p'}}{\sin\frac{\pi}{2N_{sp}}} \qquad (4)$$

Multiplying (1) by (4), and (2) by (3), it is found that the m.m.f. of a phase belt contains a fundamental component having the maximum value

$$\frac{4\sqrt{2}}{\pi} I\, n_c \sin\frac{\lambda\pi}{2} \frac{\sin\frac{\pi}{2p'}}{\sin\frac{\pi}{2N_{sp}}} \qquad (5)$$

and contains harmonic components having the maximum value

$$\frac{4\sqrt{2}}{m\pi} I\, n_c \sin\frac{m\pi}{2} \sin\frac{m\lambda\pi}{2} \frac{\sin\frac{m\pi}{2p'}}{\sin\frac{m\pi}{2N_{sp}}} \qquad (6)$$

ROTATING M.M.FS.

The m.m.fs., the values of which are given in (5) and (6), are stationary in space. In polyphase windings several such m.m.fs. are combined, developing a resultant m.m.f. which is in motion with respect to the coils that produce it. When the value of this resultant m.m.f. is obtained by means of a step curve, it is found that the shape of the m.m.f. wave, and its mean value, both change as the wave advances from point to point along the inner circumference of the primary, and that the wave as a whole travels at non-uniform speed. Many expedients have been devised for taking these irregularities into account, since the production of a sinusoidal field moving at a constant speed is a very important consideration in motor de-

sign. Failure to reach this desired end may have a very bad effect upon the rotor copper and iron loss, and starting torque.

These irregularities are due, of course, to the presence of harmonics. It is a very interesting and peculiar fact that in any machine the m.m.f. wave is made up of components which are constant in value and in speed. The value of the fundamental component of the m.m.f. curve in a machine of two, three, four or six phase-belts per pole may be found by multiplying (5) by the proper factor taken from the first row of Table I. The value of any harmonic component may similarly

TABLE I.—MULTIPLICATION FACTORS.

$p'=$	2	3	4	6
$m=$ 1	1	1.5	2	3
$m=$ 3	−1	0	0	0
$m=$ 5	1	−1.5	0	0
$m=$ 7	−1	1.5	−2	0
$m=$ 9	1	0	2	0
$m=$ 11	−1	−1.5	0	−3
$m=$ 13	1	1.5	0	3
$m=$ 15	−1	0	−2	−0
$m=$ 17	1	−1.5	2	0
$m=$ 19	−1	1.5	0	0
$m=$ 21	1	0	0	0
$m=$ 23	−1	−1.5	−2	−3
$m=$ 25	1	1.5	2	3

be found by multiplying (6) by the proper factor. The negative sign of some of these factors indicates that the harmonic in question rotates backward with respect to the main or fundamental m.m.f.

Thus in the irregular step curve of m.m.f. in any polyphase apparatus there is a constant fundamental component rotating at constant synchronous speed, and various harmonics, each of which is constant in value and rotates at a constant speed equal to $\frac{1}{m}$ th of the synchronous speed. In a two-phase machine with full-pitch winding there is a third harmonic of m.m.f. rotating backward at one-third synchronous speed, a fifth rotating forward at one-fifth synchronous speed, etc. In three-phase machines the third and all multiples vanish; the fifth rotates backward at one-fifth synchronous speed, the seventh rotates forward at one-seventh synchronous speed, etc. (In fractional-pitch windings, as noted above, certain harmonics may vanish, but the direction of rotation is always the same regardless of the pitch.)

The calculation of the magnetizing current is an important step in induction motor design. This is frequently done by finding the "equivalent sinusoidal m.m.f." whose average value is the same as that of the step curves, several of which are drawn corresponding to different instants; for example, Figs. 4, 5 and 6. This method is sufficiently exact, but is indirect. Other methods, based on empirical formulas, are lacking in generality. The writer believes that the most rational method is to base the calculation upon the fundamental component of the step curve—neglecting the harmonics, since only a small part of the total counter e.m.f. of the machine is due to them.

Let h = desired mean m.m.f. per pole.

Then from (5), making some substitutions, the following rules are obtained for calculating the magnetizing current:

In a two-phase machine the magnetizing current per circuit is

$$I=\frac{\pi^2 h \sin\frac{\pi}{2N_{sp}}}{8 n_c \sin\frac{\lambda\pi}{2}}=1.234\,\frac{h \sin\frac{\pi}{2N_{sp}}}{n_c \sin\frac{\lambda\pi}{2}} \qquad (7)$$

In a three-phase machine the magnetizing current per circuit is

$$I=\frac{\pi^2 h \sin\frac{\pi}{2N_{sp}}}{6\sqrt{2}\, n_c \sin\frac{\lambda\pi}{2}}=1.163\,\frac{h \sin\frac{\pi}{2N_{sp}}}{n_c \sin\frac{\lambda\pi}{2}} \qquad (8)$$

The following examples will serve to illustrate the application of these rules. What is the magnetizing current per terminal in a two-phase four-pole motor with 48 stator slots, 6 turns per coil, 1 circuit per phase, 83.3 per cent pitch winding, single air-gap 0.05 cm, net pole area 200 sq. cm, total flux 700,000 lines per pole?

The necessary mean m.m.f. per pole is

$$h=\frac{\text{air gap}\times\text{total flux}}{1.257\times\text{pole area}}=139 \text{ amp-turns.}$$

The magnetizing current per circuit is, from (7),

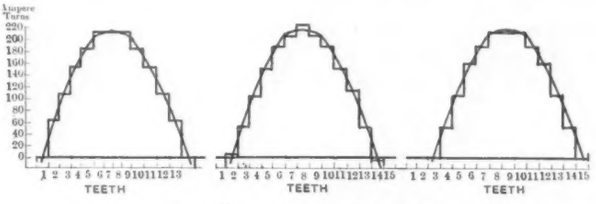
$$I=\frac{1.234\times 139\times\sin\frac{\pi}{24}}{6\times\sin\frac{.833\,\pi}{2}}$$

$=3.85$ effective amperes per circuit, which is the current per terminal since there is but one circuit per phase winding. If the same frame is wound for three-phase with delta-connection and the same flux per pole is desired, the magnetizing current will be, from (8),

$$I=\frac{1.163\times 139\times\sin\frac{\pi}{24}}{6\times\sin\frac{.833\,\pi}{24}}$$

$=3.64$ effective amperes per circuit, which is equivalent to 6.31 amp per terminal, since the winding is delta-connected.

Step curves for the three-phase machine are given in Figs. 4, 5 and 6 for 3.64 amp per circuit. Fig. 4 represents the m.m.f. produced by this current at the instant when the current in



FIGS. 4, 5 AND 6.—SPACE DISTRIBUTION OF M.M.F.

one of the phase windings is at maximum and that in the others is at half-maximum value. Fig. 5 represents the m.m.f. at a time 15 deg. later than Fig. 4. Fig. 6 represents the m.m.f. when the current in one phase winding is zero and that in the others is at 86.6 per cent of maximum value, 15 deg. later than Fig. 5. The fundamental component, a sine curve with a mean value of 139, is drawn for comparison in these diagrams. It should be noted that the step curve is practically equivalent to its fundamental, and does not deviate much from the desired sine form at any instant. This is due to the 83.3 per cent pitch which reduces the fifth and seventh harmonics to small fractions (about 25 per cent.) of their full-pitch values, as may be seen by a reference to Fig. 2. If the winding were full pitch, the step curve in Fig. 4 would have a pronounced peak, that of Fig. 5 would be bulged on one side, and that of Fig. 6 would have a flat top. The use of this pitch value results in a smoother field, and one which moves along the air-gap at a nearly uniform rate—that is, approximates closely to the motion of the fundamental component.

COUNTER E.M.FS.

If the reluctance be assumed constant over the entire air-gap area the fluxes set up by the various harmonic m.m.fs. will be proportional to the latter. Under this assumption the slot openings are considered as bringing about a reduction of the pole area merely, their effect in causing local variations of the flux being disregarded. This assumption is justified in the case of the fundamental and larger harmonics, but not in the case of a harmonic whose half-wave length nearly equals the distance between slots.

With uniform reluctance, the primary element of any polyphase apparatus is the seat of a rotating wave of flux composed of a fundamental and harmonics the values of which may be calculated by the aid of the equations given above. Of these harmonics a certain number travel in the same direction as the fundamental and others travel in the opposite direction. Since each harmonic rotates at $\frac{1}{m}$th synchronous speed and has m times as many poles as the fundamental, the counter e.m.fs. due to the harmonics are all of fundamental frequency.

The counter e.m.fs. due to the harmonics are all of the same sign and add directly to the counter e.m.f. due to the fundamental; this is true whether the harmonic rotates backward or forward, is positive or negative regardless of the pitch of the winding. Since, as will be shown later, the counter e.m.fs. due to the harmonics are vanishingly small in comparison with the counter e.m.f. due to the fundamental, it is better to base the counter e.m.f. calculation upon the fundamental only than upon the "equivalent sinusoidal field."

Let E_1 = effective counter e.m.f. due to the fundamental flux component.
ϕ = total fundamental flux.
b = coils in series per circuit.
f = cycles per second.

The following equations give the relation between flux and counter e.m.f. In a two-phase motor

$$E_1 = \frac{2\pi b n_c f \phi \sin \frac{\lambda\pi}{2}}{10^8 N_{sp} \sin \frac{\pi}{2N_{sp}}} \qquad (9)$$

In a three-phase motor

$$E_1 = \frac{1.5\sqrt{2}\pi b n_c f \phi \sin \frac{\lambda\pi}{2}}{10^8 N_{sp} \sin \frac{\pi}{2N_{sp}}} \qquad (10)$$

Equation (10) gives the delta or star e.m.f. according to the connection of the winding.

From these equations the flux necessary to produce any given counter e.m.f. can be calculated readily, and from this the necessary m.m.f. and the magnetizing current can be found, as in the above examples. The accuracy of the calculation depends only upon the assignment of the proper value to the fringing coefficient in estimating the net pole area, and upon making the right allowance for the m.m.f. consumed by the iron part of the magnetic circuit.

The effective e.m.f. E_m induced by the m^{th} harmonic of the flux wave, retaining the assumption of uniform air-gap reluctance, is determined most conveniently as a fraction of the e.m.f. induced by the fundamental. In the case of a motor with open secondary this fraction is

$$\frac{E_m}{E_1} = \frac{1}{m^2}\left(\frac{\sin \frac{m\pi}{2p'} \sin \frac{\pi}{2N_{sp}} \sin \frac{m\lambda\pi}{2}}{\sin \frac{\pi}{2p'} \sin \frac{m\pi}{2N_{sp}} \sin \frac{\lambda\pi}{2}}\right)^2 \qquad (11)$$

The ratio $\frac{E_m}{E_1}$ is very small in most cases. In full-pitch single slot windings it has the value $\frac{1}{m^2}$, and in such windings the third harmonic induces 1/9th as much counter e.m.f. as the fundamental, the fifth induces 1/25 as much as the fundamental, etc., except where the harmonic vanishes entirely, as do the third and its multiples in three-phase machines. In support of the contention that the counter e.m.fs. due to the harmonics are negligible, Table II has been worked out, giving the ratio $\frac{E_m}{E_1}$ for three motors, one of which is the three-phase fractional pitch motor referred to above; the others are full-pitch motors with the same number of slots. In motors with closed secondaries these values would be considerably smaller.

TABLE II.—VALUES OF $\frac{E_m}{E_1}$ WITH 12 SLOTS PER POLE.

	Two-phase full pitch.	Three-phase full pitch.	Three-phase 83.3 per cent pitch.
$m = 1$	1.00	1.00	1.00
$m = 3$	.0130	.000	.000
$m = 5$	.00182	.00182	.000124
$m = 7$	.00055	.00055	.000039
$m = 9$	.000243	.000	.000
$m = 11$	.000142	.000142	.000142
$m = 13$	.000101	.000101	.0001

SECONDARY CURRENTS.

The presence of harmonics in the flux wave means that "stray" currents exist in the secondary conductors of an induction motor the rotor of which is driven at synchronous speed, since the speed of each harmonic is different from that of the fundamental, and synchronism for the fundamental is out of synchronism for all the harmonics. At any slip s, the frequency of these stray currents is

$$f[m(1-s) \pm 1]$$

in which the positive sign is taken when the harmonic rotates backward, and the negative sign when the harmonic rotates forward. At standstill all of the stray currents are of fundamental frequency. At synchronism the frequency of the rotor currents in a two-phase motor is $4f$ for the third and fifth harmonics, and $8f$ for the seventh and ninth. In a three-phase motor the frequency is $6f$ for the fifth and seventh, and $12f$ for the eleventh and thirteenth. These frequencies are all high as compared with the fundamental, and therefore the torque due to the harmonics is probably very small when the speed is near synchronism.

During acceleration the harmonics may give rise to considerable torque under certain conditions, and may seriously impair the ability of a motor to start its load. For example, in a two-phase motor, at standstill, the fundamental pulls forward, the third backward, the fifth forward, etc. As the speed increases the rotor comes into synchronism with the forward moving harmonics one after another, the last one being the fifth, which is the fastest forward-moving harmonic. As soon as the rotor overtakes any harmonic the torque due to that harmonic reverses. When the rotor speed is slightly above 1/5th synchronism all of the harmonics pull backward, and the rotor speed will not rise above this value unless the torque due to the fundamental is greater than the pull-out torque of the fifth harmonic plus the backward torque of all other harmonics plus the torque required by the load. This speed is far below synchronism, and if the rotor resistance is low the torque due to the fundamental is low; thus the fundamental working at a disadvantageous speed point has to overcome the backward torque of all of the harmonics, one of which—the fifth—is at its most advantageous speed point. The available torque of a motor may be reduced materially in this way.

Mr. O. S. More, of the Western Electric Company, has observed that in certain two-phase motors running at normal speed the e.m.f. impressed on one phase winding can be reversed without causing the motor to reverse its direction of rotation, the speed merely dropping to about one-third synchronism and remaining there indefinitely. If the power is cut off, thereby allowing the speed to decrease somewhat, and is then restored, the speed returns to the one-third value. This action is undoubtedly due to the third harmonic, which becomes a forward moving harmonic upon reversal of the e.m.f. on one phase winding; the torque due to the third becomes maximum at a speed slightly less than one-third of synchronism, and the backward torque of the fundamental, under the very unfavorable condition of nearly 133 per cent slip, is unable to overcome the pull-out torque of the harmonic, and the motor cannot reverse its direction of rotation.

The effect of the harmonics is to cut notches in the speed-torque curve at certain critical speeds. To get rid of these it is desirable to use that value of fractional pitch which most nearly eliminates the objectionable harmonics.

The reaction of the stray secondary currents upon the primary is of fundamental frequency at any speed, and tends to neutralize the harmonics in the rotating field; if this neutralization is complete the harmonics will disappear and the fundamental will remain alone, but this is not possible unless the rotor impedance is zero. The neutralization is always sufficiently complete to justify the method adopted in the present article in which all calculations are based solely upon the fundamental.

The stray currents, of course, increase the copper loss of the machine as a whole, and the additional copper loss is a quantity that increases with the load. Since the harmonics are not completely neutralized, their presence leads to an increase in the iron loss; this iron loss also increases with the load, differing in this respect from the iron loss due to the fundamental.

The following conclusions appear to be justified:

1. The magnetizing current required to set up a given flux in a given frame is 6.1 per cent greater in a two-phase than in a three-phase machine.

2. The counter e.m.f. developed by a given flux in a given winding is 6.1 per cent greater in a three-phase than in a two-phase machine.

3. The exciting reactance is therefore about 13 per cent higher in a three-phase than in a two-phase machine.

4. Since the exciting volt-amperes required to develop a given flux in a given frame are independent of the number of phases, the number of slots, the pitch of the winding, and the number of turns per coil—that is, are independent of the winding, machines should not be compared on the basis of the exciting volt-amperes, but rather on the basis of the exciting reactance.

5. The use of a suitable fractional pitch for the windings results in the reduction of the secondary copper loss and the iron loss, and smoothes out the low points on the speed-torque curve.

6. To secure these advantages the best winding pitch for three-phase machines is about 83.3 per cent, and for two-phase machines about 75 per cent.

The Weiss Laboratory Electromagnet.

By M. P. Misslin.

NO modern electrical testing laboratory can be considered as having a complete equipment of apparatus without possessing an electromagnet of great strength. Especially during the last few years such magnets have formed the object of a series of studies tending not only toward a perfection as far as their construction is concerned, but chiefly also toward obtaining magnetic fields of as high intensity as possible.

Thanks to the researches of Stephan[1], the most advantageous form of pole-pieces has been known for some time, but the question as to the dimensions to give the magnetic circuit has generally not been solved in the same satisfactory way.

The usual procedure to obtain powerful magnetic fields consists in magnetizing two cylindrical coils, separated by a gap, parallel to their common axis. In order to obtain the maximum possible intensity of magnetic field, it is evident that it is necessary to produce in the pole-pieces a magnetizing intensity as near as possible to saturation. With most of the magnets previously designed it is impossible to approach sensibly such density, as will be shown in the following:

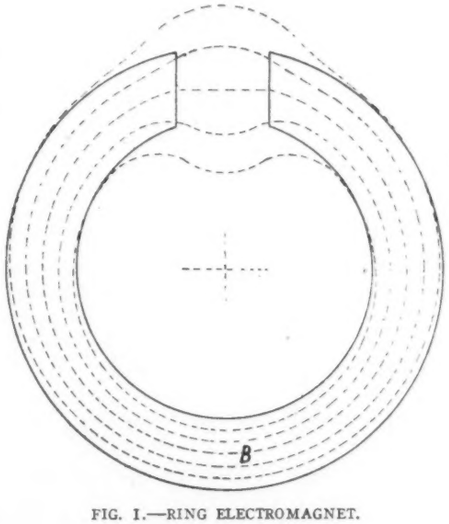


FIG. 1.—RING ELECTROMAGNET.

Fig. 1 shows a ring interrupted by a gap and the magnetic field produced by means of a winding uniformly distributed over the whole ring surface. It will be noted that the density is not the same in all parts of the ring and that the derivations of the flux increase toward the poles. The part *B*, most distant from the poles, will thus become saturated first and will play the part of a second gap, whereas the remaining portion of the ring will behave as if the magnetic circuit were opened at *B*.

In Fig. 2 the field produced in the air-gap has been recorded as a function of the magnetomotive force as the curve *O P Q*. The magnetic contraction produced by the saturation of the

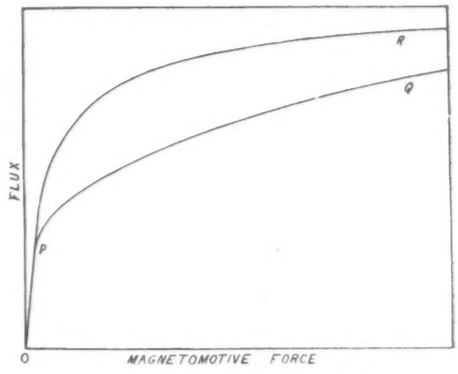


FIG. 2.—SATURATION CURVES.

section *B* (Fig. 1) takes place at the bend *P* (Fig. 2). From this point the increase of flux is so slow that experiments which may be carried out will have to be interrupted long before the flux has reached its maximum value, which corresponds to the saturation of the pole-pieces, owing to the excessive heating of the magnetizing coils. For the above reasons it is not possible to obtain saturation of the pole-pieces with a magnetic circuit of uniform cross-section.

The above facts, first described by P. Weiss[2], have for a long time been misunderstood and even at present they are often contested. As a matter of fact, most of the electromagnets for sale to-day have magnetic circuits of uniform cross-section. At first sight it would seem that the magnetic contraction at *P* (Fig. 2) can be displaced by giving the magnetic circuit a section varying over its whole length, and that the contraction could completely be avoided if the section at each point were so proportioned that saturation takes place simultaneously over the whole circuit. The curve *O P Q*, in Fig. 2, would then be replaced by curve *O P R*.

To arrive at simultaneous saturation over the whole range of the circuit the following rule must be observed: The section of the magnetic circuit measured at the greatest distance from the air-gap, to the section measured at the air-gap, must decrease gradually in such a way that saturation will be retained up to the poles in spite of any loss of flux by leakage. Evidently, saturation is of importance at the poles only, and therefore the portions of the magnetic circuit distant from the gap can be given a greater section than would be demanded by the above-mentioned rule. It is even of advantage to adopt the latter method, because instead of wasting flux over the greater portion of the circuit the circuit may be magnetized to less intensity without changing the flux passing to the poles. As a matter of fact, in order to obtain an intensity of magnetization 20 per cent smaller than the maximum intensity at the poles a field only 1 per cent as powerful will suffice. It follows that in increasing all of the sections of the magnetic circuit which are not close to the poles, in the proportion of 1:5, an enormous saving in the number of amp-turns required may be realized. By employing this principle, Prof. P. Weiss has designed the laboratory magnet which is clearly shown in the illustrations (Figs. 3, 4 and 5), which was made by the Maschinenfabrik Oerlikon, Switzerland.

The magnetic circuit is formed by a heavy U-shaped yoke of extra soft steel, carrying two cylindrical cores 15 cm in diameter of the same material. The yoke is cast in one piece and offers the rigidity absolutely necessary for a design in which the attraction of the two poles may attain 4400 lb. The cylin-

[1] *Wied. Ann*, p. 440; 1889.

[2] *Bulletin* des séances de la Société Française de Physique. (1er et 2e fascicules, 1907.)

drical cores threaded at one end can be moved forward and backward by means of suitable gearing, so that the distance between the poles can easily and accurately be regulated. The whole apparatus is carried by a vertical pivot so that the magnet can be set to any azimut by means of a worm gearing operated by a hand-wheel.

The bobbins are placed as closely as possible to the pole-pieces to avoid too great a derivation of the flux. The first electromagnet (Fig. 3), built for the laboratory of the Institute of Physics at Zurich, has bobbins formed of copper tape 1 mm in thickness and 15 mm in width, wound up helically, the windings being separated by an insulating tape 0.2 mm in thickness. Each bobbin is formed of 15 divisions, held together by tapes and spaced 3.5 mm apart from each other.

In using copper tape in place of copper wire a saving of about one-third of the bobbin volume has been effected, the result being a corresponding shortening of the magnetic circuit.

The two bobbins have been calculated very liberally, in view of the manifold requirements which the magnet should meet.

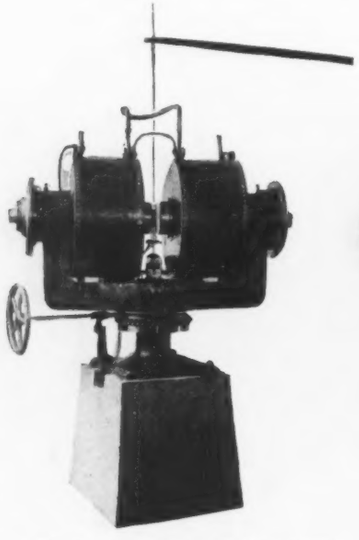


FIG. 3.—ZURICH ELECTROMAGNET.

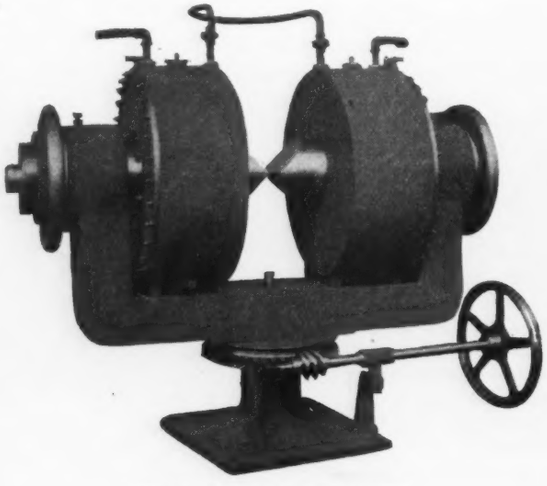


FIG. 4.—PARIS ELECTROMAGNET.

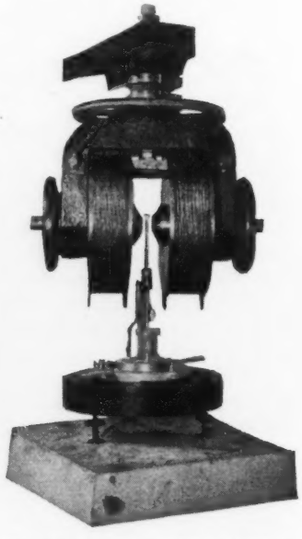


FIG. 5.—GENEVA ELECTROMAGNET.

Each bobbin has 1600 turns of a section which will carry to 60 amp, so that a maximum total m.m.f. of about 200,000 amp-turns is obtained. The total resistance of the bobbins, when cold, amounts to 4.9 ohm. As the total power consumed by the magnet amounts to 18 kw, special provisions had to be made to permit the carrying off of the heat produced. For this reason the bobbins are enclosed in suitable receptacles filled with paraffin oil, through which cooling coils are run.

After a rather long use of the apparatus, the increase in temperature of the cooling water did not exceed 20 deg. C. and the pole-pieces remained perfectly cool. The artificial cooling adopted in the first instance to accommodate the necessary number of amp-turns has in actual use proved still more valuable, owing to the constancy of the temperature in the space occupied by the magnetic field, thus doing away with the numerous troubles experienced with older designs resulting from the heating of the pole-pieces. The magnet has been provided with a number of different pole-pieces, the form of which must be decided according to the special services the magnet has to perform.

In Fig. 3 the magnet is illustrated with pole-pieces of parallel, vertical end surfaces. To permit the carrying out of magneto-optical experiments the magnet cores have an opening drilled through their whole length, which—in order to avoid any reduction of the section for other experiments—can be closed up by inserting accurately machined plugs.

Most of the experiments carried out with the first apparatus built did not require more than 25 amp. A second magnet (Fig. 4), supplied to the Ecole Normale Supérieure de Paris, has, therefore, been built with a less number of amp-turns. The bobbins of the latter magnet have 10 divisions, each with 75 turns, so that a total of 1500 turns is obtained. The resistance of these bobbins, cold, is 2.5 ohms. With this magnet a m.m.f. up to 150,000 amp-turns could be obtained.

For research work requiring a large air-gap it is preferable to retain the number of amp-turns of the first apparatus described. A third magnet, similar to the one above described, has been supplied to the Bureau of Standards at Washington.

Smaller magnets, with bobbins of copper wire, but designed on the same principle, and for m.m.fs. up to 30,000 amp-turns, are turned out by the Société Genevoise pour la Construction d'Instruments de Physique et Mécanique, Geneva (Fig. 5).

With magnets as described above it has been possible to establish fields of higher intensity than were obtainable previously. For instance, a field of 46,000 gausses was obtained with the magnet at Zurich, with pole-pieces having the form of truncated cones, whose smaller bases had a diameter of 3 mm and which were separated 2 mm from one another. This field exceeds by about 8000 gausses those which have been obtained for distances of the same magnitude by magnets of other design.

In this connection, the accompanying table, giving results of tests on Creusot steel and Swedish iron, carried out with the Zurich magnet, with truncated pole-pieces 10 cm in diameter at the larger surface, and 3 mm diameter at the truncated end, and a separation of 1.95 mm between poles, as reported by Prof. P. Weiss[3], will certainly be of interest.

Distance between poles = 1.95 mm.

Creusot Steel.		Swedish Iron.	
Amp.	Gausses.	Amp.	Gausses.
0.625	11,650	0.625	12,030
1.25	21,400	1.25	21,670
2.5	28,750	2.5	29,150
5	35,480	5	35,700
10	41,100	10	41,300
20	43,830	24	44,670
30	45,130	29	45,110
42	45,710	40	45,650
53	46,250		

Bavarian Water Powers.

Ministerialrat Stengler has recently made a report on the proposed development of water powers in Bavaria. Five hundred thousand hp could at once be utilized without any difficulty, perhaps even 700,000 hp. The State proposes to reserve for its own use one-fifth of the 500,000 hp—that is, 100,000 hp; this would include the electrification of railroads; 400,000 hp would be available for industrial purposes.

[3] *Bulletin* des séances de la Société Française de Physique. (1er et 2e fascicules, 1907.)

Lane Technical High School, Chicago.

WITHIN the last few years there has come into being a widespread demand for practical industrial education for the benefit of those boys (and perhaps girls) who must leave school at a comparatively early age to earn their own living and who have no hope or desire of reaching the technical college, or are, perhaps, not intellectually equipped for the thorough scientific study which must underlie an engineering education. This subject attracted attention at the recent educational convention in Denver, and in his annual address on that occasion as president of the National Education Association Mr. Lorenzo D. Harvey said: "For the great mass of those needing industrial education the existing public schools, elementary and secondary, must furnish the facilities. They must recognize that the great majority of their pupils must earn their living by their hands, and they must undertake to give definite instruction and training for at least the beginning of industrial efficiency."

In Chicago a new public high school was dedicated on Washington's Birthday, 1909, which is of exceptional interest, as indicating the effort that is being made to grapple with this problem. It is the Albert G. Lane Technical High School at Sedgwick and Division streets, and although open less than a full school year it had, at the end of the school year in June, about 1500 pupils in charge of 55 teachers. The pupils are all boys, and they appear to be enthusiastic in their work. While some of the boys are preparing for technical colleges, the majority of them are taking the school work with the idea of securing practical training that will be of immediate help to them as wage earners or in business after they leave school. Practical electrical instruction forms a part of the course, although not a very conspicuous part as yet. All machinery and machine tools are electrically driven by individual motors or through shafting, and there is an isolated plant for generating electricity which is probably the largest in any technical high school in the country. This plant has a rated capacity of 600 kw, and as it is capable of 25 per cent overload its maximum capacity is 750 kw.

FIG. 1.—GENERAL VIEW OF LANE TECHNICAL HIGH SCHOOL.

FUNCTIONS OF THE SCHOOL.

At the recent dedication to which reference has been made the principal of the school, Mr. William J. Bogan, delivered an address on the functions of the school, in which he said the school was designed with practical education as its keynote and the making of an honest living as its goal. To this end the Board of Education has provided the best building, the best tools and the best machinery that could be secured. Mr. Bogan said that teachers make a great mistake who believe that all pupils are given an equal chance through the workings of the old-time course of study. He asked if the boy with a taste for mechanics has an equal chance in the ordinary high school with the girl who takes all the Latin and Greek that is offered her and then cries for more. Much of the high school education in the past has been, as one critic phrases it, "a merry-go-round for girls," the impracticability of which the speaker illustrated by telling a story of a Norwegian servant girl who seemed to do everything the wrong way. This girl made a failure of scrubbing; she wrecked the kitchen stove, and in ironing scorched the daintiest garments. Finally, in a moment of exasperation the mistress said: "Well, Hulda, is there anything you can do?" "Y-aas," answered the servant, "Ay can milk a reindeer."

Statistics of school attendance show that only a small percentage of pupils complete the work of the elementary schools and that a large number never go beyond the first half of the elementary grades. In Chicago there are thousands of boys and girls between the ages of 14 and 16 who are not in school and are not at work. In Chicago there are 17 high schools, two of which are technical high schools; and it is significant, as pointed out by Mr. Bogan, that nearly 50 per cent of all the boys in the city high schools are in these two schools. The average loss in Chicago high schools between the first and second years is 35 per cent, while at the Crane Manual Training School on the West Side the loss is only 17 per cent. In the judgment of Mr. Bogan these facts justify the erection of schools where practical education is emphasized.

One feature of the Lane school is the night sessions attended largely by men. Mr. Bogan told his hearers that it would stir their blood to spend an evening going through the school and questioning these adult pupils as to the reason for their attendance. One man of 55, for instance, said that he was a blacksmith's helper, but that he didn't intend to be a helper all his life. The principal of the school expressed himself as dissatisfied with the existing curriculum and said the course should be made much more practical than it is at present. The fact should be boldly faced that only a small percentage of the students who enter high schools will ever go on to college, and the energy of the secondary public schools should not be directed toward the development of the few at the expense of the many. Referring to industrial training in penal institutions for the young, Mr. Bogan made the striking statement that it long has been a reproach that only through the commission of a felony can a boy secure the education best suited to his needs. The education fitted to reclaim a youthful criminal is the kind of education best suited to the prevention of crime. Emphasis should be placed on shop work rather than on academic attainments that will lead only to college.

Mr. Bogan gave his ideas as to the manner in which the course could be modified advantageously to make it more practical, and in concluding he said: "I often wonder what it is in our make-up as teachers that impels us to stand afar off and gaze at our work through the telescope of tradition and precedent, which magnifies the importance of Greek and Latin and ancient literature, while we ignore the pitiful sight of mankind on its knees offering up the prayer in all its terrible literalness, 'Give us this day our daily bread.'"

STUDIES AND EQUIPMENT.

The present schedule of studies which Mr. Bogan thinks might be improved embraces three four-year courses—Latin, modern language and scientific. The subjects ordinarily taught in high schools are included with the addition of such subjects as mechanical and freehand drawing, woodworking, gymnasium exercises, blacksmithing, foundry and pattern work and machine-shop practice. In the scientific studies emphasis is placed on physics and chemistry of course.

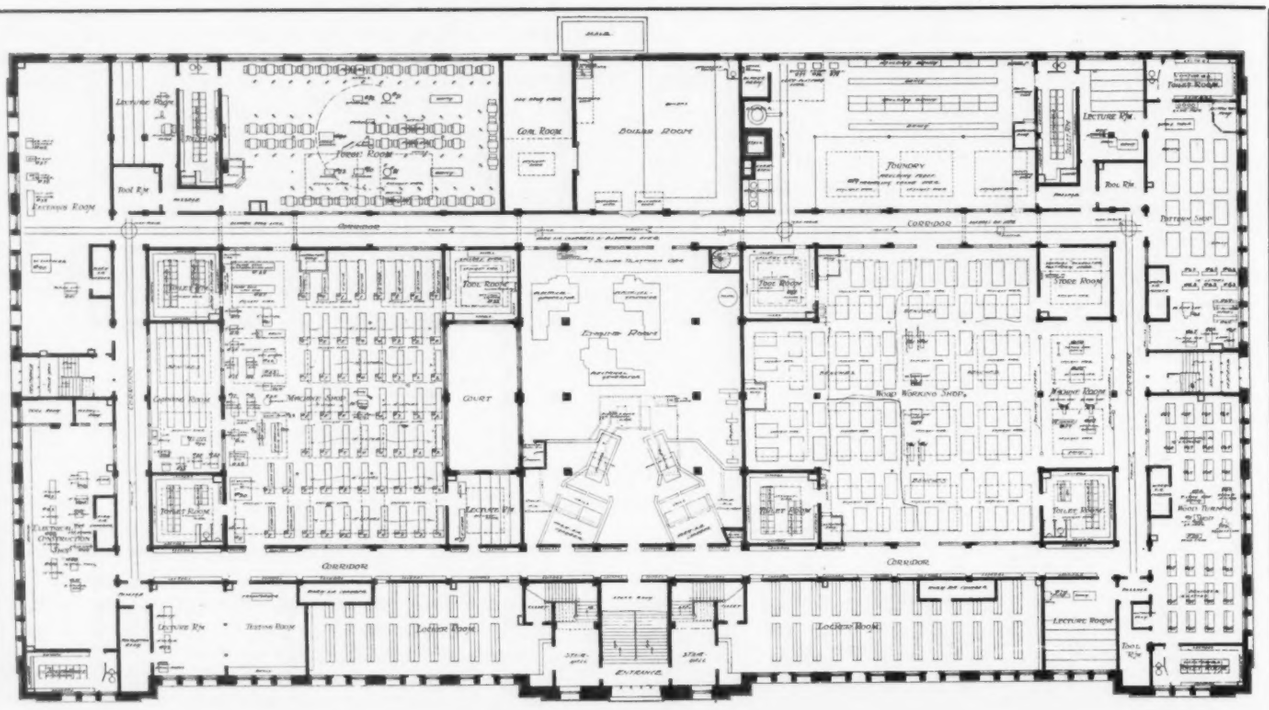


FIG. 2.—GROUND-FLOOR PLAN.

FIG. 3.—VIEW IN ELECTRICAL CONSTRUCTION SHOP.

LANE TECHNICAL HIGH SCHOOL, CHICAGO, ILL.

The Lane school will accommodate 1600 students, divided into three periods in the daytime and one in the evening. The shops located on the ground floor have a working capacity of 400 pupils during one period, the working unit being 24 pupils or one-half of the unit of the other departments, which are arranged for 48 pupils. On the ground floor of the large building are the locker rooms, machine shop, chipping and receiving rooms, woodworking shop, foundry and forge department, pattern and woodturning shops and also the electrical construction shop with its lecture and testing rooms. The power plant is also placed on the first floor, with ample accommodations for coal storage, boiler room and engine room. Above the ground floor are two upper floors, while in the central portion of the building there are a fourth and fifth floor. The second and third floors contain the principal's office, laboratories, drawing departments, library, assembly hall and a large number of class rooms. There is a lunch room with kitchen on the third floor, and the fourth floor is given over to the gymnasium which is supplied with a running track, shower baths and the like.

A conspicuous feature of the ground floor is the machine shop, which is 60 ft. x 80 ft. in size lighted by skylights and side transoms from the courts. The shop is equipped with machinery for 72 pupils and this machinery consists of lathes, drills, grinders, milling machines, planers, crank shapers, boring and turning mill, an automatic screw machine, etc. In all there are 82 machines in this shop. At the foot of each engine lathe in the machine shop is a small vise bench provided with five individual student's drawers and one general tool drawer, as well as two compartments for storage of work under construction. A tool room also is connected with the machine shop.

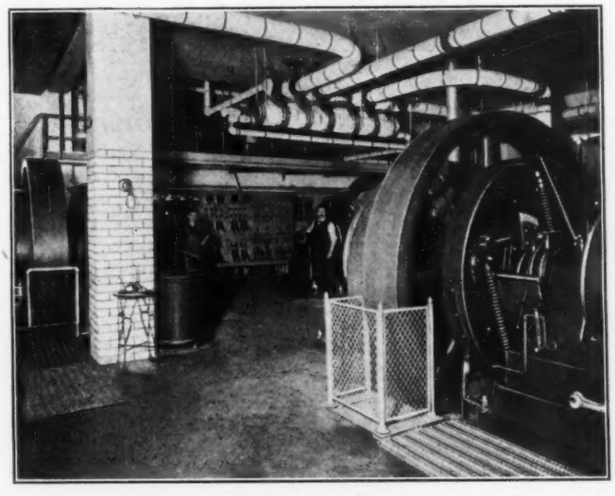


FIG. 4.—PARTIAL VIEW OF POWER PLANT.

The chipping room is provided with benches to accommodate 24 pupils. This shop is equipped with six machines, consisting of crank shapers, grinders, drill press and tool-tempering furnace.

The woodworking shop is equipped with 72 double work benches, giving a student capacity of 144. It is provided with band saws, planers, boring machines and other equipment. The pattern shop likewise is completely equipped. The same is true of the wood-turning shop.

The foundry is 40 ft. x 80 ft., having a floor composed of round cedar blocks, with crevices filled with sand. This shop has been equipped for the accommodation of 40 pupils and has a two-ton cupola and a one-ton traveling crane with other necessary machinery. The forge room is similar in size and has been equipped with 48 down-draft forges. Under each of the forges are located steel cabinets, each containing three individual student's drawers for the storing of tools.

All the shops are provided with lecture-rooms, and there is also a receiving room where is stored all materials and supplies needed in the shops and other departments. Various motor-driven tools are placed in the receiving room.

The building has ground dimensions of 331 ft. x 174 ft., and with its equipment cost about $750,000.

POWER PLANT.

The power plant of the Lane Technical School includes three 200-kw, 220-volt, direct-current Western Electric generators, directly coupled to Russell four-valve engines. There is also a compensator set rated at 14 kw and designed to care for an unbalanced load of 125 amp. Steam is furnished to the engines by three 350-hp Freeman water-tube boilers provided with Swift automatic stokers in which screenings are burned. Draft is provided by a 125-ft. brick stack. A large part of the load on this plant is due to the various motors for driving the machines in the school shops, and also the ventilating fans and other apparatus needed in the operation of the school building. There are 47 motors installed in the building and they have a combined rating of about 450 hp, ranging from 2 hp to 100 hp, the latter machine being used to run the machine shop. The lighting system includes 62 arc lamps and about 3000 incandescent lamps ranging from 16 cp to 50 cp. The arc lamps are placed principally in the shops and in the gymnasium. The switchboard in the power plant is a handsome structure of gray Vermont marble with eight panels—three for the generators, one for the compensator, two for motor circuits, and two for lighting circuits. The equipment of boiler-feed pumps, house pump, air compressor, feedwater heater, oil separator, etc., is placed in the engine room, and the whole plant is clean, airy and well kept, so that it may be easily inspected by the students. The building is heated by exhaust steam from the engines. The electric wiring, switchboard, generator and engine equipment, together with the installation of motors, was designed and superintended by Pierce, Richardson & Neiler, consulting engineers, Chicago. The heating, ventilating and boiler-room equipment throughout was designed by the engineering department of the Board of Education, Chicago.

ELECTRICAL INSTRUCTION.

The pupils' work in the electrical department at present consists mainly of the construction of motors and generators. The department contains a construction shop, a testing-room, lecture-room, battery-room, toolroom, stockroom and locker-room. The construction room is equipped with lathes, drills, punch presses and all other machines necessary for the lighter machine work. The heavier work, such as boring out frames, is done in the main machine shop of the school, which is equipped for such work with large lathes, vertical borer, planer, radial drill and other machines. All of the lighter machining is done in the electrical construction shop—such as turning shafts, commutators, and machining small pieces. The winding and testing of armature and field coils are also done in the construction shop, the room being equipped with a power winder and testing boards.

The testing room is used for experimental work and for testing the power, efficiency, permeability, heating, etc., of machines. It has a triple-current Roth Brothers motor-generator, which gives, in connection with a storage battery, all direct-current voltages up to 220, and all alternating voltages from 5 up to 200, supplying several switchboards throughout the school with these voltages, including two-phase and three-phase alternating currents. The lecture room has a large distributing and demonstrating switchboard; also a transmission and reflecting optical lantern, a large assortment of continuous and alternating current machines in various stages of completion, and such other apparatus as may be necessary in order to show the methods of designing, constructing and testing electrical machines.

The battery-room contains a storage battery of 24 American cells, so arranged that they may be connected to give any voltage from 2 to 48, in steps of two. There is also a supply of various kinds of primary cells. This room adjoins the lecture room and thus allows two wires from each cell to be run directly to the main switchboard, so that the battery voltage

may be regulated or the individual cells tested by the lecturer before a class. The toolroom contains all such tools and supplies as are likely to be used in the construction of electrical machines or apparatus; and the stockroom contains material, such as insulation, brass, copper, iron and steel of all desired dimensions and shapes, together with asbestos wood, electrical molding, conduits, and the like. The locker-room contains an iron locker for each pupil, a large number of washbowls, and the usual toilet-rooms.

From the beginning it has been the aim to put the electrical department in such shape that all work could be turned out according to approved methods, and so that all finished machines not rejected would be in no way inferior to those of the best shops. No reasonable expense has been spared for machines, tools or material.

There are both day and evening classes. The day classes continue for the full school year, averaging an hour a day, while the evening classes last one-half year with two hours a day. In the day classes fourth-year pupils only are allowed to take the electrical work; and as they have just had a full year in the machine shop and a half-year of the study of electricity (physics), they are qualified to take up the electrical construction work.

The evening pupils consist of those who have had no electrical instruction in any way, others who have had shop work or wiring, and others who have had both study and practice. Thus classes are formed in beginning electricity, others in shop work and others in advanced electrical work. As many as six teachers were employed in the evening school, including an expert machine man and an armature winder.

In both the day and evening schools, however, much of the

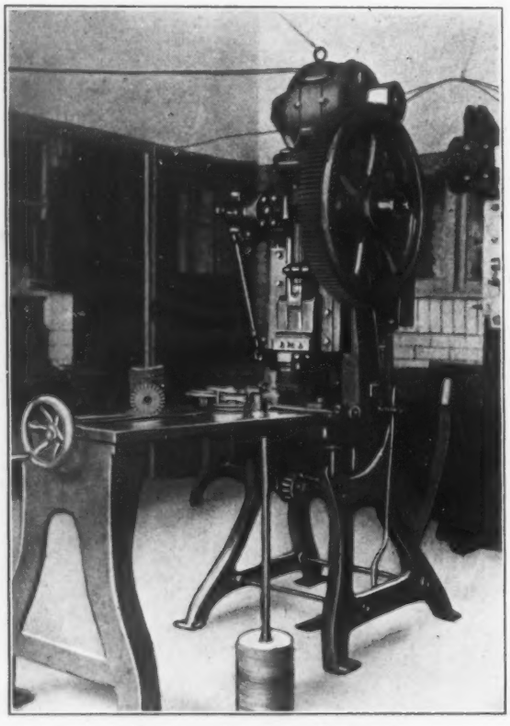


FIG. 5.—ARMATURE-DISK NOTCHER.

work is done by pupils in other departments of the school. In the day school the patterns are made by the first-year pupils; the more difficult ones by night pupils of some experience; the molding and blacksmithing are done by the second-year pupils, and some of the machining, drafting and blueprinting by the third-year pupils. All of the electrical work, however, is done by the fourth-year pupils—that is, the designing and all work involving insulation or requiring electrical knowledge such as the winding and connecting of coils, the building of commutators and assembling and testing machines. The general plan of instruction is somewhat similar to that which is in vogue in the evening school.

The construction work has to be carried on constantly with a view to the ability of the pupils. They are not experts such as are usually employed at similar work. The machines which are to be made have to be designed with reference not only to efficiency and economy, but also to the inexperience of the workmen. The insulation must be a little thicker or of better

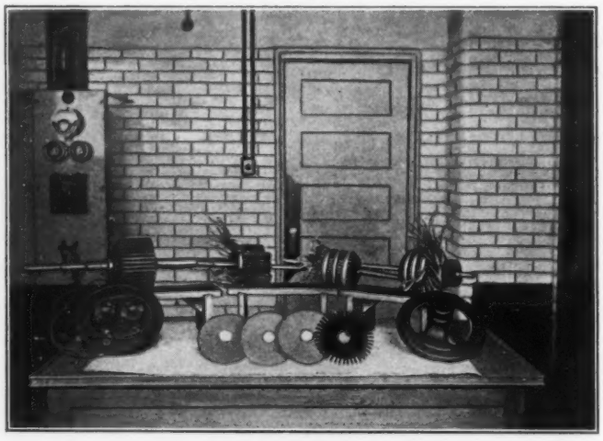


FIG. 6.—ARMATURES IN PROCESS OF CONSTRUCTION BY PUPILS.

material, or "shorts" or grounds will develop. The machines, for given output, must be slightly larger than usual so that the armature slots may be large enough to force in the coils without injury, so that the shaft bearings may allow slightly more winding space, and so that the magnetic reluctance may be sufficiently low in spite of slight defects in the yokes, in the contacts between yokes and poles or in other portions of the magnetic circuits.

For punching the armature disks special guides are needed so that they can be quickly and accurately applied, and that the fingers will be protected. A boy punching a few hundred disks, perhaps setting guides but once, cannot do so as accurately and quickly as an expert. And if much time is lost on each portion of the work but little can be accomplished during the year, as much of the work has to be rejected and repeated. Therefore, the dies and guides for punching the disks and for notching them have been so designed that they can be instantly set, will remain accurate and are practically fool proof.

Also in varnishing the notched disks, rollers cannot well be used where the varnishing is done only for an hour or two once or twice a week, as too much time would be wasted in keeping the varnish from caking. Hence, a centrifugal method has been designed which, with the boys, is more rapid than the roller and fully as effective. Jigs for quickly fitting and rigidly holding parts to be machined also have been designed. The aim throughout is to enable the pupils to devote as much time as possible to the actual construction work.

Designing the machines to meet the needs of the inexperienced boys does not need materially to affect the efficiency or the size of the motors or generators, but it does materially affect the work of the instructors. The instructors need to be not only skilled mechanicians, but also electrical engineers with thorough technical training and much experience in designing and manufacturing. They should also be good teachers, because they come more intimately in contact with each pupil than at almost any other line of teaching, and as the pupils are usually much interested in the work and frequently expect to make it their life work, the influence of the instructor for good or evil is very great.

Mr. Ernest J. Andrews is director of the electrical department. Thanks are due both to Mr. Bogan and Mr. Andrews for assistance in the preparation of this article. Some of the photographs reproduced herewith were taken by pupils, members of the Lane Camera Club.

CENTRAL STATION
MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Coal Hole Sign at Middletown, Ohio.

The Middletown Lighting Company, of Middletown, Ohio, is utilizing the sidewalk coal hole in front of its office for advertising purposes. Use is made of a glass cover with a sign lettered on the glass. Underneath the glass is a lamp with a "skidoodle" socket, giving a flasher effect, which on the unsuspecting passerby is sometimes quite startling.

Tungsten Sign Lamps at Canton, Ohio.

The Canton Electric Company, of Canton, Ohio, is experimenting with tungsten lamps for electric signs. Its rate on 4-cp carbon-filament sign lamps has been $2 per year per lamp. It is now making a rate of $1 per year for a 4-cp, 5-watt tungsten sign lamp, including renewals. These lamps are placed 11 in series on a 115-volt circuit. It is hoped to extend greatly the use of electric signs by means of the low rate which is made possible by a tungsten lamp. Mr. W. C. Anderson, the manager of the company, however, regards the business as somewhat experimental until more is known about the performance of the tungsten sign lamp.

Peculiar Turbine Arrangement at Canton, Ohio.

The Canton Electric Company, of Canton, Orio, is operating a steam turbine under unusual conditions. The turbine is a 500-kw Curtis machine and is sometimes operated in the ordinary manner by supplying high pressure steam to the first stage, which then passes to the second stage. It is frequently operated, however, as a low-pressure turbine in connection with the exhaust of one of the steam engines in the station. When so operated, the exhaust of the engine is supplied to the second stage. The first stage is, therefore, out of action. The second stage works as a low-pressure turbine deriving most of its power from the vacuum maintained by the condenser. In order to provide against slowing down the turbine under over-load, the throttle is open so that high-pressure steam will be supplied by the governor to the first stage whenever the speed falls below a predetermined amount. The governor is so adjusted that under ordinary conditions no high-pressure steam is supplied, but the governor will open the valve to admit high-pressure steam the instant the speed falls.

Commercial Use of Ozone Generators.

That ozone can be commercially produced in quantity by means of electric discharges of high frequency through the atmosphere has been known for many years, and in Europe the process has received considerable application. At present there seems to be a tendency to make a more extended commercial use in this country of apparatus embodying this principle. Several companies are placing on the market ozone generators, and activity in this direction seems to be especially marked in Chicago. Machines are produced for office use and also to be placed in the home, particularly in sleeping apartments to keep the air fresh and invigorating during the night. It is asserted that persons troubled with insomnia have received benefit by the production of a moderate degree of ozone in their sleeping-rooms at night. Larger machines are made to be used in public buildings or assembly halls, and there is an installation of this character in the Chicago Public Library, where an ozone generator is placed in one of the air ducts provided for ventilation. The ozone generators are made both for alternating and direct current, although in the latter case a small motor generator is usually made a part of the machine. This commercial use of ozone indicates another possibility in the way of new business for the central station, and as such is perhaps worthy of attention. The Ozone Pure Airifier Company, of 160 Adams Street, and the National Air Filter Company, of 199 East Madison Street, both of Chicago, are concerns which are engaged in pushing the sale of ozone generators.

Record of New London (Wis.) Light and Waterworks.

The municipally owned electric light and waterworks of New London, Wis., of which Mr. H. C. Sterling is superintendent, is operated under the supervision of a commission, and has recently made a statement covering the period of 15 months ending June 30, 1909, complying with the order of the State Railroad Commission. The electric light plant is credited with gross earnings amounting to $11,887.94. Deducting operating expenses from this has left a net profit of $3,556.98. The waterworks, which is operated by the same force in the same building, is credited with gross earnings amounting to $3,815.60, with expenses of $3.554.31. The commission in its report explains that the loss on the waterworks operation is due to an expenditure of $203.25 in a last attempt to secure a pure water supply; otherwise, a profit of about that amount would have been made. The general balance sheet shows assets in the shape of electric and water plant, etc., of $67,761.03. Bonds outstanding amount to $48,500. It is impossible to entirely separate the electric and water investments. However, taking the report as to the value of the various parts of the plant, it is found that $19,693.93 consists of items which are evidently entirely electric investment, and that $36,059.88 consists of items entirely applying to the water investment. The balance of the investment consists of items so divided between electric and water service that no separation can be made. The striking thing about the report is the fact that the electric gross earnings are about three times the water gross earnings, while the water investment is apparently about double the electric investment. New London has a population between 3000 and 4000.

Campaign for Electric Refrigeration in New Jersey.

BY WILLIAM H. STUART.

The Public Service Corporation of New Jersey recognizing the value of electric refrigeration in its territory, has instituted a campaign to secure it. While this year the work has not been carried along on any large scale, preparations are being made for an extensive campaign which will open early next year. Throughout the State there are quite a number of large meat and food product warehouses and storage plants. In Jersey City especially there are quite a few, this city being the termini of four or five large trunk line railroads. Newark, Hoboken, Camden, Paterson, Plainfield and Perth Amboy are other cities where there are a number of large refrigerating plants. Besides the business from this source a great many of the large residences scattered throughout suburban New Jersey have small refrigerating plants. Thus the business has been divided into two classes, known as commercial and residential.

About a month ago the Public Service Corporation called a meeting of the power solicitors from all over the State at the home office in Newark. This was for the purpose of giving a special and practical demonstration of an electrical refrigeration plant and ice-making machine in actual operation. Price talk combined with selling points and actual advantages were

brought before the solicitors. Examples of refrigeration plants operated by isolated generating systems which had been abandoned for central-station service and valuable suggestions on introducing central-station service in places where ice, brought from ice dealers, was the means of refrigeration were brought before the solicitors.

The company has made a special rate for this business on the larger plants. For all energy consumed during the summer months a net rate of 3 cents per kw-hour is made. For the balance of the year the rate is increased 1 cent, making the rate 4 cents per kw-hour net. A minimum charge of $1 per horse-power connected per month is made on all installations. This rate is given to all consumers whose equipment is larger than a 1-hp motor. On installations of 1 hp or smaller the consumer is placed on the regular power rate. This schedule has a base rate of 10 cents per kw-hour with liberal discounts that bring it down to 3 cents per kw-hour. The discounts are governed by the maximum demand. It is estimated that for refrigeration equipments of from 1 hp to 20 hp about $7 worth of ammonia is required per year. This does not apply to the ice-making equipment.

Since bringing the matter before the solicitors, quite a few large installations have been fed from central-station service in each of the larger cities. Of the commercial business quite a large-sized load has been acquired. As the season is well advanced at present no elaborate plan for securing all the business possible is used. The solicitors are, however, giving the matter considerable attention. Next year the idea will be to have special literature sent out to every prospect and to follow all inquiries up closely. The present soliciting force will take care of this end of the business. The manufacturers of refrigeration apparatus will all be invited to co-operate in this work. Two of the largest manufacturers have signified their intention of entering the territory with a well-equipped sales force. About January active work will be started on the plans for this work so as to have the situation well in hand.

That this business is profitable is already proved by the installations connected at present. The majority of the installations are in use 10 hours each day, although some of the larger plants operate on a 24-hour basis. This load comes on early in the day and is thrown off just before night. The storage boxes are kept closed all night without undue drop in temperature. An automatic device regulates the apparatus so as to keep an even degree of temperature at all times. While the first cost of an electrical refrigerator is considerable, the owners are satisfied with the saving accomplished over ice cooling. The Public Service Corporation is entirely satisfied with the gain in this business so far this year and looks forward to a greater increase next year.

Benefits Derived from Development of Electric Heating Devices.

By H. W. Hillman.

Without considering most carefully the development and extension of electric heating devices, many may fail to realize the important relation of this particular class of development to other branches of the industry. In the erection of a new home the owner does not now consider whether it will be lighted by electricity or gas, but the question is how many of the convenient outlets and extra receptacles does he require to have a modern house. The miscellaneous electric heating devices have been so extensively introduced that there has been a marked increase in the manufacture and sale of sockets, receptacles, wire, knobs, cleats and other interior wiring devices. The manufacturer has not only gained in this respect, but the wonderful extension of the electric flatiron has been no small factor in promoting the continual demand for steam turbines and increased generator capacity. More and more the equipment of central stations will be taxed by the speedy introduction of the electric flatiron, and the electric manufacturer benefits by the sale of the apparatus. He will still further be benefited, and to a large degree, when the electric light and transmission companies take advantage of the sale of energy for many industrial purposes other than motors and lamps.

After the manufacturer, the lighting and power companies will be benefited from the development and introduction of electric heating devices. A display window and exhibition-room never cease to attract the attention of the people. There is a novelty about electric devices aside from their convenience which people enjoy, and they do not fail to show their appreciation. Therefore, the lighting and power companies are forcibly and valuably advertised in this manner. The income to the central station is gradually increasing to a substantial sum, and as every central-station manager is searching for ways and means of increasing the earnings, the benefit in this respect from the heating branch of the industry is decidedly welcome.

A few years ago no engineer or central-station manager anticipated that a substantial income would be secured from the introduction of flatirons, yet to-day it is an established fact that the income is substantial, and the business is permanent and profitable. Recently, through the aggressiveness and activity of the manufacturers and engineers, the electric toaster has been produced, which is so simple as to attract unusual attention. Its initial cost is low, and it is considered exceedingly durable and practically indestructible. If station managers will now stop to consider what an excellent income-earner this device promises to be, the toaster will be installed in every home where the flatiron is now used. A central-station company recently claimed that 75 per cent of its residence customers are using electric flatirons and within six months every house wired will own and use an iron. The same situation can be brought about with the toaster, and the central station will benefit thereby.

Admitting that the manufacturers and central-station companies profit by the extension of electric heating devices, what about the public? Can it be shown that all three parties interested are benefited? Surely, the public has shared in the benefits to the fullest extent. It wants convenient devices for the home, and appreciates improvements which will save money. The wonderful development of the electric coffee percolator is interesting to relate. Only a few years ago it required 12 to 15 minutes for the device to percolate. One of the first improvements in the design decreased the time required to about 8 to 10 minutes. A new idea was again presented, and four to five minutes was the result of that improvement. Now coffee percolators are being produced which will percolate in 50 seconds. The public always benefits when a saving in time is effected, and experience has given it confidence in electric heating devices. As a consequence, such devices will be more quickly and broadly extended than in the past.

The flatirons, toasters and percolators are emblems of engineering activity and advancement, for which much credit is due, and this credit belongs to the electric heating engineers. The public believes in convenient electric devices. Watch persons while attending electrical shows at Chicago, New York and elsewhere. They gather about the booths which exhibit the electric household utensils. They eagerly ask questions about the vacuum cleaner, and upon return to their homes the central stations receive requests in connection with these popular electric devices. If the people were not benefited then one might expect that they would cease to exhibit an interest. Such is not the case. Every exposition attracts more and more interest.

In the development and extension of electric heating devices the benefits are not confined to a particular class of people. On the contrary, all classes are benefited. The servant girl who irons out on the piazza where it is cool and pleasant work appreciates the electric iron. She tells her friend, who is still using the old method, and time and experience show that servants are now demanding these benefits. The heating branch of the electrical industry is destined to grow to enormous proportions because so many of the miscellaneous devices have been made durable as well as convenient and are sold at popular prices. At no distant date electric cooking and baking outfits will be ready for greater extension and more aggressive attention by all interested.

The writer took a meal recently in a New England home where a 6-lb. roast beef was cooked in an up-to-date kitchen coal stove in one and a half hours, at a cost, approximately, of 6 cents. A day later the same kind of dinner was cooked with an electric outfit and an 8-lb. roast was cooked in one and one-quarter hours, with only 1200 watts of energy at a cost of 6 cents. There was 33 per cent more food product to be cooked and it was cooked more quickly, and at the same cost of coal, also without the bother and inconvenience of ashes, coal and constant attendance.

Why should not the future look bright for electric cooking and baking? Opponents have said that electric stoves are slow and inefficient. Let them now investigate the new heating units which are so vastly superior to the past development as to call forth the heartiest congratulations among the electric heating engineers associated with the art. Electric stove lids consuming only 400 watts or 500 watts, and reaching a satisfactory heat in 17 seconds, represent an advance in the art of heating that will cause the most conservative engineers to admire the progress which is really being made. Notwithstanding that the new unit is highly efficient and wonderfully rapid, it is said to be remarkably durable. The most exhaustive tests have failed to show that the unit is not durable.

A recent visit to the heating department of one of the largest manufacturers has made the writer more enthusiastic than ever on the subject of electric heating devices. Ample evidence is offered to show that the development and extension of this art has been of great benefit to the manufacturers, to the central stations and to the people in general.

INTERIOR WIRING AND ILLUMINATION

Superior (Wis.) Ornamental Street Lighting.

The ornamental street lighting of Superior, Wis., which was described in these columns May 27, is the subject of an appreciative article in the *News-Tribune* of Duluth, which is reprinted below. As there is a strong rivalry between these neighboring cities, the compliment paid to the lighting is an exceptional one.

"HATS OFF TO SUPERIOR.

"The Duluthian who visits Superior at night, or who, looking down from the boulevard after nightfall, sees the fairy land of light below him and notes the brilliant line marking our sister city's chief thoroughfare, must acknowledge that the people across the bay have shown Duluth how.

"Tower Avenue at night is a 'Great White Way.' Its lighting is artistic and fascinating. At each corner, and at regular intervals in each block, is a handsome iron post supporting a cluster of lights. The effect is not only brilliant, but most alluring.

"The avenue is made one long promenade; it is a place where men and women, young folks and old, will delight to take an evening stroll, meeting friends and exchanging greetings. It gives all the pleasure and enjoyment of a night park.

"It is a gorgeous evidence that the spirit of progress is abroad in Superior. That its men are willing to pay good money for the beautiful. That they have not surrendered to Mammon, but are willing to divide with the populace.

"More than this, it is evidence that they have a great pride in their city, and that enterprise will greet enterprise as comrades. It is the sign of a warm welcome to a wide-awake city such as people may be glad to make their homes, and where they may safely invest their capital.

"Duluth has been dallying with a similar project for First Street. If the property owners on that street would visit Tower Avenue, they would not linger longer in well doing. First Street is Duluth's coming business thoroughfare. It needs such an attraction to draw the people, and Duluth needs it to relieve the uncomfortable congestion on Superior Street."

The Mercury-Vapor Lamp in Signs.

A comparatively recent adaptation of the Cooper Hewitt mercury-vapor lamps is in electric sign work. Two examples of this sort are illustrated herewith. In Figs. 1 and 2 the glass sign, "Reuter's Fine Candies," suspended over the sidewalk in front

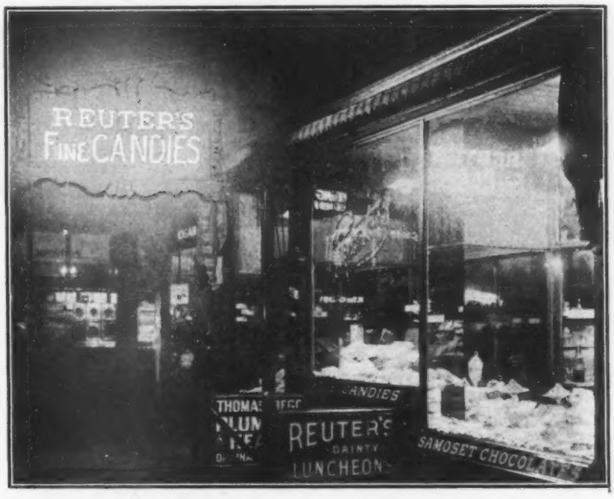


FIG. 1.—MERCURY-VAPOR LAMP IN SIGN LIGHTING.

of a candy store on Randolph Street, near Dearborn Street, in Chicago, is illuminated by a mercury-vapor lamp tube in a regular holder. The tube is operated on a 115-volt direct-current circuit and takes 3½ amp. It is rated at 700 cp, and it is interesting to note that seven ordinary carbon 16-cp lamps having

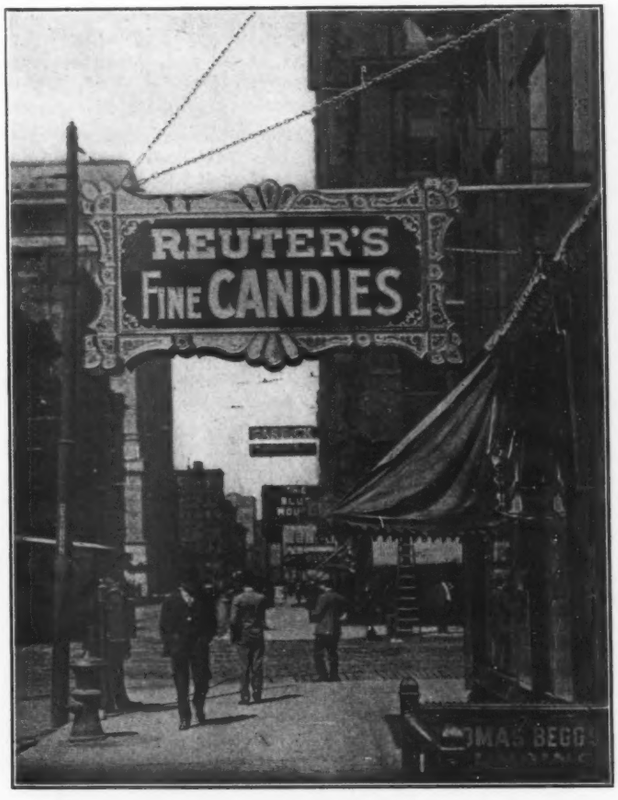


FIG 2.—MERCURY-VAPOR LAMP IN SIGN LIGHTING.

112 cp would consume the same amount of energy. The tube is wired from the sign to the auxiliary, which is placed within the building. The sign is made of beveled glass decorated in chipped and burnished gold. It is about 5 ft. long and 2 ft.

deep, and consists of two sides about 8 in. apart. The mercury-vapor tube is placed within this space and the greenish-blue light shines through letters of frosted glass, giving an unusual and individual effect. The background of the lettering is of

FIG. 3.—GLASS-BARREL SIGN ILLUMINATED BY MERCURY-VAPOR TUBE PLACED INSIDE.

glass rendered opaque by black enamel so that the light is only seen through the letters in sharp contrast to the background. The mercury-vapor tube is placed in the center of the space, but the light is well distributed and the letters are evenly illuminated.

In Fig. 3 is shown a glass barrel which is illuminated from within by a Cooper Hewitt mercury-vapor lamp of the same size as that used in the Reuter sign. This barrel is suspended in front of a liquor store on Randolph Street, near Clark Street, Chicago, and is a handsome piece of leaded art-glass construction.

The staves of the barrel are reddish brown, while the hoops or bands are black. The lettering on the sides is in white opalescent glass. The head of the barrel, which shows white in the picture, is of "flashed" frosted glass. Formerly the barrel contained 16 16-cp carbon-filament lamps. Electric signs with mercury-vapor lamps have been in use only a few months in Chicago, and owing to the characteristic color of the light they attract considerable attention.

Flaming-Arc Lamps on a Detroit Power House.

Advertising illumination is very effectively employed by the Murphy Power Company, of Detroit, Mich., in the form of a number of flaming-arc lamps disposed about the roof line and smokestack of its power house on the corner of Wayne and Congress streets, in that city. There are 21 Excello flaming-arc lamps on the roof, and four are placed about the square portion of the stack extending above the roof. The roof lamps are placed about 150 ft. above the street, while the lamps on the smokestack are 60 ft. higher up. They are connected five in series on 250-volt, direct-current circuits, and are suspended on brackets extending out 16 ft. on the corners of the building and 12 ft. on the sides between the corners. The lamps are rated at 3000 cp each, and are of the 10-amp type burning 17 hours on one trimming.

It is reported that the Murphy Power Company spent about $5,000 in making this installation of flaming-arc lamps, and that it is very well satisfied with the result attained in making its building conspicuous at night. The installation has been satis-

FIG. 1.—DAY VIEW OF FLAMING-ARC LAMPS ON DETROIT POWER HOUSE.

factory, and has required very little attention. The company before making this arc-lamp illumination considered the advisability of outlining the building in incandescent lamps, but

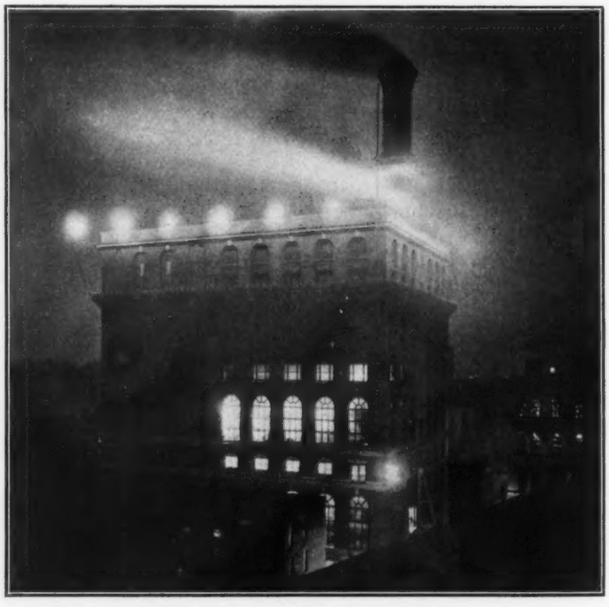


FIG. 2.—NIGHT VIEW OF FLAMING-ARC LAMPS ON DETROIT POWER HOUSE.

it was calculated that in five years the saving in consumption of electrical energy of the arc lamps compared with the incandescent lamps would be sufficient to pay for the arc-lamp installation.

Advertising Illumination for a Theater.

Situated a little to one side of what has been considered the downtown theater district in Chicago, the American Music Hall, of 440 Wabash Avenue, formerly the Garden Theater,

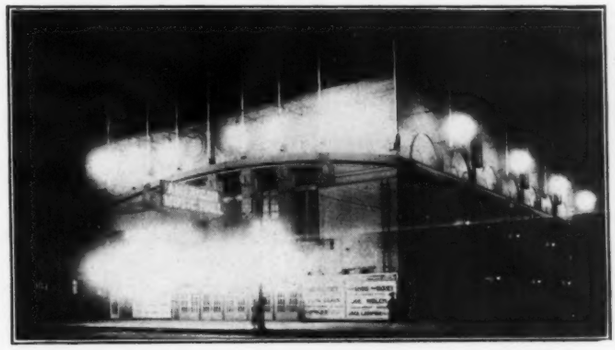


FIG. 1.—FLAMING-ARC LAMPS, AMERICAN MUSIC HALL, CHICAGO.

makes itself conspicuous by 12 Excello flaming-arc lamps of 3000 cp each. Ten of these lamps are suspended from brackets near the roof line of the building, six on the Wabash Avenue side and four on the Peck Place side. Two of the lamps are

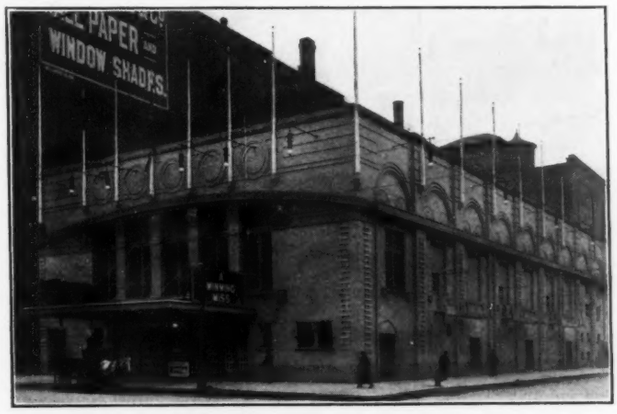


FIG. 2.—FLAMING-ARC LAMPS, AMERICAN MUSIC HALL, CHICAGO.

placed under the sidewalk canopy at the Wabash Avenue entrance to the theater. The brightly lighted corner can be seen from a long distance at night.

New Telephone Patents.

HIGH-TENSION LINE GUARD.

Where high-tension lines cross telephone lines, the latter are exposed to the dangers of high voltage crosses unless some special protection be provided. Of course, the normal separation is more than sufficient for safety, but should the wires break the lines might become crossed. To obviate this danger

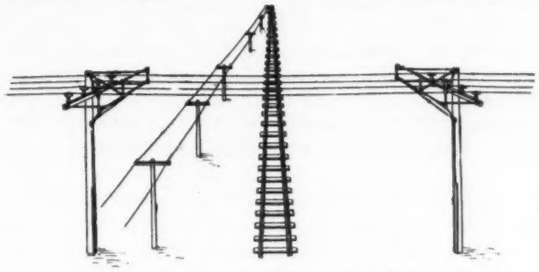


FIG. 1.—ELLIOTT GUARD FOR WIRES.

many sorts of cradles and guards have been tried, and Mr. C. J. Elliott, of Oxnard, Cal., has obtained a patent for one type of guard. This is shown in Fig. 1, and comprises a heavy conducting and grounded cage mounted on the high-tension pole. If the wires part in the exposed span, if they sag down, the contact with the grounded frame causes the wire end to burn off and fall to the ground.

GROUP-EXCHANGE SYSTEM.

To save the wire plant, it has been suggested to associate a group of neighboring subscribers upon automatic switches distant from the central office, trunk wires being extended to the latter. It is with such a system that the patent of Mr. D. W. May, of Kansas City, Mo., is concerned. He uses three-wire trunks to the switch point, the automatic switches being arranged to select automatically the first non-busy trunk for an originating call, and, under the control of the central-office operator, to select any local station for an incoming call. As soon as a selection of trunk or line is made, the signals are given as though the connected station were on a direct line from the exchange.

NEW APPARATUS.

Mr. F. R. McBerty, of New York City, has patented a type of single-contact relay wherein the plane of the armature is parallel to the core axis. An end view is shown in Fig. 2,

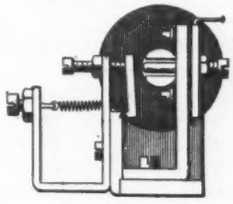


FIG. 2.—M'BERTY RELAY.

from which the arrangement will be understood. The Western Electric Company has obtained the patent by assignment.

A transmitter is the subject of a patent granted to Mr. F. Gottschalk, of New York City. The novelty lies in a cup-piece mounted upon the center of the diaphragm and so registering with the mouthpieces as to concentrate the mechanical effect of all received sound at that point.

A wall-set cabinet has been designed and patented by Mr. A. Larsson, of Buffalo, N. Y. This is of sheet steel following the generally approved shape of common-battery shelf sets, but having an extension below the shelf adapted to enclose two dry cells.

LETTERS TO THE EDITORS.

Depreciation.

To the Editors of Electrical World:

SIRS:—When we see the results of the operations of certain electric corporations, as well as municipal plants, and note their financial condition, it is very evident that proper attention has not been given to the matter of depreciation, and that too much money has been taken out of the plant for dividends or otherwise or else that sufficient income has not been received to warrant the proper charges to the depreciation account. During my connection with the Salem (Mass.) Electric Lighting Company many changes have taken place through replacement of out-of-date apparatus and I have had an opportunity of seeing the necessity of taking care of these charges out of earnings, where they properly belong. In a way, it makes no difference to the public whether these earnings are used for renewals of apparatus at the time the change is made or whether higher rates have to be paid for energy on account of interest charges on greater plant accounts, the result of failure to charge proper amounts for depreciation in the years past.

There are two ways of looking at this matter: One is whether a corporation shall always apparently be poor, with consequent impairment of service; the other is whether it shall have foreseen the future by keeping down to a proper level the plant valuation and thereby appearing to be wealthier in consequence and better able to supply high-grade service.

I am afraid that there are too few companies that realize the advantage of and that do make a true inventory of their property. Failure to do so means ignorance of the true value of the assets. If this should be a State or Government requirement—and the writer is very much in favor of State supervision where business-like and practical—it would be to the benefit of the corporation as well as to its stockholders to require plant conditions to be kept up and excessive capitalization to be kept down. Excessive capitalization must be determined to the interests of the public and to the corporation, both as a purveyor of public service and as a safe and sure investment for the public. It seems to me that no better example of this very idea can be found than by referring to the conditions of electric lighting companies in Massachusetts. Most of these companies show, where it is possible to make a living, excellent results, but there are, no doubt, instances where electric lighting companies show very meager returns on the capital invested and ought never to have been started. I cannot help feeling that the matter of depreciation enters most seriously into the operation of every electric lighting plant.

Salem, Mass. S. Fred Smith.

A Purchasing Agent's View of the Jobber.

To the Editors of Electrical World:

Sirs:—Your editorial in the issue of July 29, entitled "The Electrical Contractors' Convention," strikes a right chord. It has been said, by a man prominent in matters electrical, that any one who styles himself "a jobber" is so accepted by the Jobbers' Association even though he has but a miniature office with a "5-ft. shelf" of catalogs and a lady typewriter, whereupon he can obtain jobbers' prices and sell to the big contractor and to the still bigger consumer—the central station.

Another phase is the opening of a "supply store" (often not larger than the office of the above-mentioned jobber) by a small illuminating company, to which are then granted jobbers' prices. Some of the largest consumers have no supply stores, but buy very much larger quantities than those who possess such outlets for the sale of accumulations of short lengths of wire and broken package goods or of odds and ends which go out at a good profit; but the big central stations prefer to confine themselves to sticking to their legitimate line—that of generating and selling electrical energy.

In answer to the query, What does the jobber do for the manufacturer, it may be replied that he does for him as much as possible. He prints a catalog replete with lots of illustrations and takes the customers' orders for *everything*, but creates no demand. If, unfortunately, he is too small to have an individual catalog, he proceeds to get busy with a rubber and erases the name of the compiler from the top of each page and rubber-stamps his own instead; or perhaps makes up "a neat scrap book" with clippings from others' catalogs, and thus fortified sallies forth as a jobber to take orders.

Manufacturers know that to get their goods directly into the hands of the big buyer means missionary work on their own part, but missionary work becomes tiresome and unprofitable if done merely to enable the jobber to take orders. Selling to big consumers is less expensive, less uncertain of results and of payment and more satisfactory in that the manufacturer knows his goods are being used, and can follow up complaints, look after the consumer in general for future business and increased orders.

Jobbers have been known to jump from one manufacturer to another for the slightest discount. They naturally prefer to sell that class of material which pays the best profit. The consumer will listen to the manufacturer's representative regarding quality and method of manufacture as he knows him to be posted, the result being that he receives the big consumer's order at a price satisfactory to the latter and secures a steady customer. A visitor to the writer illustrated the situation by employing a Spanish proverb, translating it into the vernacular: "Show me your order and I will show you my price"; and the big buyer may rest assured that so long as he buys only from manufacturers, he will be kept in touch with the market and know the different grades of material. You say "Competition among manufacturers will regulate matters," and "it is right that it should;" also "That quantity governs price," therefore, why should not the buyer who purchases big quantities be granted big discounts without the bugaboo of the Jobbers' Association interfering?

Detroit, Mich. H. L. Jackson.

Safety Service Box for Induction Motors.

To the Editors of Electrical World:

Sirs:—The writer is very much interested in the article in your issue of Aug. 12 by Mr. Robert J. Young on "Electrical Accidents Around Machinery and Their Prevention," which has the merit of novelty. We have plenty of Underwriters' rules and regulations for the protection of property, but the human being seems to have been left to look out for himself.

For some years it has been the writer's duty to secure adequate and fool-proof electrical machinery for severe service in coke-oven and chemical plants, and the lack of safety appliances on the market has been found very marked, though the alternating current is now so prevalent, with its higher voltages and consequent greater danger to life.

It is no uncommon thing to find 20,000-volt line wires run down a side wall of some small substation, from the lightning arresters to the transformers, bare, or very inadequately covered with insulation, and a continual menace to the station attendant or some ignorant helper who may be employed to clean up around the apparatus, or some carpenter making repairs. As to danger from shocks due to grounds, usually, in the case of large industrial systems operating motors in wet and inaccessible places, the circuits are grounded, and, of course, it is only necessary for some careless person to touch accidentally an exposed live contact to receive a shock that may be fatal on even such a low voltage as 440. Skilled electricians are not in so much danger as are the ignorant helpers and laborers; the electrician knows what to expect from an apparently innocent-looking wire or terminal, but the non-technical man may accidentally or unconsciously make a contact, particularly if the motor is idle and the machinery driven by it is shut down.

It is right here that I wish to call attention to the universal practice of supplying induction motors of all voltages with the open type of fuse panel, with the terminals and metal ends of the enclosed fuses always alive—a relic of the early days when voltages were low, and now continued on not only 440-volt motors, but also, I am told, on motors of 6600 volts right in New York and Brooklyn power houses. These exposed fuse panels are a serious menace; the terminals are alive whether the motor is running or not, in the majority of cases, where the starting compensator is used without an extra line switch to cut off the current. Most persons on seeing that a motor is not running are not so careful around the wiring and fuses, thinking, if at all, that the current is off.

I wish to cite one instance of fatal shock resulting from the comparatively low voltage of 440 volts, 60 cycles, directly due to this condition. A machinist took opportunity to work at night when the motor was idle in order to erect a shield over the machine to keep off water, and being tired with his long day's work rested himself by leaning one hand on the slate fuse panel that belonged to the idle motor. He received a fatal shock from the 440-volt current, and his hand gripped the support so hard that his helper could not detach him; there was no way of shutting off current except from the power house, a quarter of a mile away, and by the time that help had arrived, and the man was pulled away from the terminal, he was beyond recovery. Now this motor was not running, the starter having cut off the current, but the line, fuse and compensator terminals were fully alive and there were no means at hand to render them quickly and safely dead.

The writer then took up with many of the concerns all over

the country the question of securing a safety type of induction-motor service box that would prevent such accidents. The ordinary cast-iron box with removable fuses would not answer because there was no way of by-passing the starting current of the motor around the fuses to allow the use of proper sizes of fuses to protect under running conditions. No company could furnish such apparatus from anything that it had previously built, and the writer then developed and patented a type of service box for induction motors of all voltages having the following desirable features not previously to be found in apparatus on the market:

1. A service box that would by-pass the starting current of the motor.

2. That would remain closed to the entrance of dirt, foreign matter or moisture, whether the contacts of the same were in the open or closed condition. (All present boxes are wide open when they interrupt the circuit.)

3. That could not be opened or tampered with by any but the authorized attendant, and yet that could be used to open the circuit in case of need by anyone.

4. That, once opened, could not be closed again until the proper attendant had investigated the trouble and taken his precautions.

Some such safety appliance should be required by wiring rules just as much as any fire-protective device, as the present fuse panels supplied with motors of all voltages are a constant menace to life of non-technical laborers, helpers and workmen.

SYRACUSE, N. Y. H. WALTER SYKES.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Triple-Frequency Currents in Neutrals of Three-Phase Star-Connected Alternators.—E. W. MARCHANT AND J. K. CATTERSON-SMITH.—The authors show how triple-frequency currents arise in the neutrals of three-phase, star-connected alternators. The effects (increased heating, wrong indications of power-factor meters) produced by such currents are considered, and finally means are indicated for rendering these effects negligible. The authors think that alternators running in parallel should have their neutrals earthed and that choking coils between the neutral points of each machine and earth are the best means of preventing triple-frequency currents.—Lond. *Electrician,* Aug. 6.

Direct-Current Turbo-Dynamos.—E. ZIEHL.—The conclusion of his long illustrated article on direct-current turbo-dynamos. He now gives details of the best construction of the brushes and brush holders to insure sparkless commutation. Means are also discussed for reducing the troublesome noise of turbo-generators. It is usual in Germany to enclose all turbo-dynamos, although this necessitates artificial ventilation and reduces the efficiency of the machine.—*Elek. Zeit.,* Aug. 5.

Lamps and Lighting.

Street Lighting.—L. BLOCH.—The first part of an illustrated review of recent progress in street lighting. The first installment deals with progress in gas lighting, and discusses the Lukas lamp, upright compressed gas lamps and inverted gas lamps. Some data are given on gas lighting in several streets of Berlin; in one of them the horizontal illumination at the height of 1.5 m above the ground was measured at different points between inverted compressed gas lamps and was found to be between 0.99 and 1.9 lux. The ratio of both figures is 52, which indicates a considerable lack of uniformity of illumination. The mean horizontal illumination of the whole streets is 18 lux, which is rather high for German conditions, although the same mean value is reached in the illumination of various places in Berlin by means of flame-arc lamps.—*Elek. Zeit.,* July 29.

Street Lighting.—L. BLOCH.—A continuation of his serial on progress in street lighting. In the present installment the author deals with electric street lighting, and discusses the introduction of Nernst lamps, tantalum lamps and tungsten lamps for these purposes. The disadvantages of metallic-filament lamps at present are their high price and their sensitiveness with respect to vibration. For the present a voltage of 110 is far preferable to 220. The tungsten lamp now also begins to compete with smaller types of arc lamps, tungsten lamps being made for 200 cp to 400 cp, consuming 1.1 watts per candle. For this high candle-power 110-volt lamps are just as good as 220-volt lamps, with respect to price and durability. With respect to the total cost of current, renewal of lamps and attendance, these lamps can successfully compete with arc lamps with pure carbons for smaller currents. Though they are less brilliant and, therefore, less effective than arc lamps, they have the great advantage that they need not be cleaned. Graphitized carbon lamps are also being used in Europe. The author makes some remarks on series connection and parallel connection of incandescent lamps; the parallel connection is almost universally used in Europe. With respect to arc lamps he mentions that enclosed arc lamps have not by any means found as much favor in Europe as in the United States. In Europe the chief importance appears to be laid on a light source of high efficiency and on good illumination of the streets and much less on the cost of attendance. The magnetite arc lamp has not been introduced in Europe. The mercury-vapor lamp in the form of the new quartz-type lamp is in its external form quite similar to an arc lamp, and is useful for lighting streets in which the objectionable green color of the light is of no importance—for instance, freight stations, docks, storehouses, etc. The manufacture of quartz lamps has recently been taken up by several large arc-lamp factories. Finally, the development of the "intensive-flame arc lamp" is described. In its early history the gases evolved from the impregnated carbons caused many troubles. They are liable to destroy the regulating mechanism of the lamp and to have a corrosive effect on the glass globes. It is, therefore, of great importance to remove these gases as quickly as possible. An arrangement for this purpose is shown in Fig. 1. Air is introduced from the outside at the bottom of

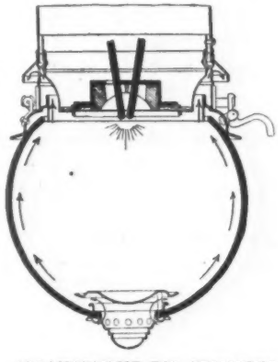


FIG. 1.—ARRANGEMENT FOR REMOVING GASES.

the globe and then passes in the globe, along the inner surface, in the direction of the arrows, preventing a contact of the gases from the arc with the globe. Immediately above the globe the air leaves the globe again and takes the obnoxious arc gases away by means of suction, so that these gases cannot have an unfavorable effect on the globe and the regulating mechanism. Formerly a glass globe was practically destroyed by such corrosion within six or eight weeks, while with a proper ventilation the globes are now still in good condition

after a year. To prevent corrosion still further, the globes when cleaned are suitably rubbed on the inside with a mixture of kerosene and paraffin oil. Formerly cleaning by means of diluted acids was employed, but this has not proved successful, and is, moreover, very inconvenient.—*Elek. Zeit.*, Aug. 5.

Physiological Effects in Illumination.—An editorial referring to the fact that metallic-filament lamps with clear globes are now often used and directly fitted in the old shades for the carbon lamps, which were made for very much smaller lamps. The result is that a metallic filament is left generally quite unobscured and its intrinsic brightness has a painful effect on the sensitive eye. Frosted lamps should be more generally adopted. Reference is made to the recent article by S. W. Ashe in *Electrical World*, and a former investigation by Broca and Laporte on visual acuity for different colors.—Lond. *Electrician*, July 30.

Stage Lighting.—V. Paetow.—An illustrated description of a new system of stage lighting. It is an indirect lighting system operated by arc lamps so as to produce diffused light similar to daylight.—*Elek. Zeit.*, July 29 and Aug. 5.

Generation, Transmission and Distribution.

Textile Mills.—H. W. Wilson.—A paper read before the (British) Inst. Mech. Eng., reviewing the arguments for and against the use of electrical transmission as the method of conveying power to the various departments of a textile factory. The main differences of opinions among engineers designing the lay-out of electrically equipped mills arises over the question of group or individual driving. The author is in favor of the individual driving of ring spinning frames and the group driving of all other machines, but keeping the groups fairly small. The mere substitution, as in some factories, of a large motor for the rope pulley on a line shaft can hardly be regarded as the final step in the adaptation of an electrical installation to suit textile manufacturing needs. A point needing attention is the heating effect of the motors. It is now the best practice to build motors for a ring spinning-room with hollow frames, and to bring cooling air from some external source round the frames, thus preventing the discharge of heat to the room. A few notes are given at the end on the horse-power required by different machines.—Lond. *Electrician*, July 30.

Railway Generating Station.—A fully illustrated description of the new power house and the outlying substations of the Coney Island & Brooklyn Railroad. This company, during the past two years, has completely reconstructed its power generation and distribution system, replacing 19 direct-current units in three power stations with two 3500-kw turbo-generators delivering 11,000-volt alternating current, which is transformed in three substations to 600-volt direct current for feeding to the trolley.—*Elec. Rail. Jour.*, Aug. 4.

Boilers.—J. Izart.—An article on the maintenance of boilers for central stations. The importance of purifying the water for the reduction of fuel consumption is pointed out, and notes are given on the purification of boiler waters and the regular cleaning of boilers at intervals, emphasizing the necessity of not only internal but also external cleaning.—*L'Industrie Elec.*, July 10.

Operation of Bessemer Converter Plant.—F. Hartig.—The conclusion of his illustrated description of the electrically operated blowing system for the converters in the Peine rolling mills, giving results of tests, ec.—*Elek. Zeit.*, July 29.

Traction.

Single-Phase Versus Direct-Current Traction.—F. Eichberg.—A reply to the criticism of H. F. Parshall, which formed part of a discussion of Murray's paper on the New Haven electrification. The present author endeavors to show that the reasons why Parshall prefers direct current are wrong. On the basis of several years' experience, he claims that the cost of maintenance and the certainty and safety of operation are at least equal with the alternating-current system to anything that has so far been obtained with an equivalent direct-current equipment. "It is quite impossible to compare the results of American railways, where combined alternating-current and continuous-current equipments are generally adopted, with the results obtained on European lines. The combined system must be incomplete and unsatisfactory, because the number of parts and the complications are more than double those of a simple single-phase system, and the consequent cost of maintenance and up-keep must be much greater. European engineers have never recommended the use of the combined system." Lines which are purely urban, such as the underground railways in London and New York, may work best with continuous current or with single-phase currents. Every such case must be considered by itself. Suburban railways (Stadt-und Vorortbahnen) and long-distance lines can only be equipped economically and with certainty of safe operation with alternating current. The overhead-conductor system is the only one permissible in connection with main-line railway electrification. Complicated switch yards and freight yards cannot be equipped with the third-rail. The third-rail increases the cost of maintenance of the permanent way and renders it much more difficult. The overhead-conductor system is far better from a mechanical point of view and much safer than the third-rail. The total cost, including the power station and distribution, as well as the motor equipment, is much cheaper for single-phase than for direct-current, and the general over-all efficiency is greater with alternating current than with direct current. As to the development of the modern single-phase system, it is pointed out that, "for example, the Hamburg car is better in its mechanical details than any existing direct-current car, and the catenary overhead construction is 10 times better from a purely mechanican standpoint than the third-rail."—*Elec. Rail. Jour.*, Aug. 7.

Electric Drive and Marine Propulsion.—A. J. Maginnis.—In a paper on the advance of marine engineering in the early twentieth century, the author discusses the direct electric drive for propellers as follows: The fact that the coming power for marine propulsion must be directly rotary coupled with the success of the steam turbine has brought forward another system, which, in the author's opinion, will soon be widely adopted—namely, the application of electric power direct to the propeller shaft. The advantages likely to accrue from the adoption of direct electrical shaft drive are: (1) Reversal of the propeller with full effective power is attained and readily effected. (2) The design of both the steam and electric plant can be so modified as to enable the naval architect to make better and more profitable arrangements for both passenger and cargo space. (3) The movements of the propellers can be controlled direct from the bridge. (4) Electricity, like steam, is capable of being readily applied to all the other requirements of shipboard, such as steering, windlass and winch work, with more economical distribution. It is not proposed to use electric drive on fast vessels (naval or mercantile), where the turbine has been so successful, but to apply it to the slower-going cargo tramps, as if the promises now put forward are carried out it will present the most simple means of obtaining rotary motion slow enough to apply to the ordinary screw propeller working at from 70 r.p.m. to 120 r.p.m. "Should this system of main electric drive come about, it may be safely said that a new era of electric navigation is about to dawn, and one promising great results. For instance, the continued decrease in the boiler pressures as commenced with the steam-turbine machinery will, no doubt, be further continued, and even lower pressures than now exist will be made use of, which will largely decrease the weight of boiler installations and so cheapen the first cost. Through the fact of the greater portion of the machinery being electrical, other than mechanical, the heavy weights of such moving parts as pistons, piston and connecting rods, valves, etc., will be done away with, and so render the outfit and overhauling of the electric boat more simple and more easily effected than on the steam-propelled craft at present in use."—Lond. *Electrician*, Aug. 6.

Installations, Systems and Appliances.

Electric Lighting and Central Stations.—K. Hahn.—If the electric lamp shall replace the kerosene lamp in comparatively small residences, this can be accomplished only by low-candle

power metallic-filament lamps. If for the lighting of a residence seven incandescent lamps, each of 18 watts, and four incandescent lamps, each of 6 watts, are to be used in a flat, the total consumption is 150 watts, and if 400 hours of burning are assumed the yearly consumption is 60 kw-hours. If a rate of 10 cents per kw-hour is assumed, the yearly cost for current is $6, the cost for the renewal of lamps $2.50 and the cost for the measurement of the current also $2.50. Hence the total is $11 per year. This is by no means higher than the cost of illumination by means of kerosene lamps. The author does not believe that lamp manufacturers will succeed in making economical and durable low-candle-power lamps for relatively high voltages. He, therefore, concludes that central stations will have to reduce the voltage of distribution. In alternating-current plants small transformers for reducing the voltage may be employed, but even in such stations a general reduction of the voltage is recommended for most cases, with separation of the large motors from the lighting network. For new plants it is recommended to employ a 2×55-volt network. The author then discusses the question whether it is preferable to measure the current or to employ a flat rate. With the types of meters now on the market it is difficult to measure the small quantities of energy which are here to be taken into consideration, and in many cases the measuring of the current will be more expensive than its generation. The writer, therefore, advocates the flat rate. In order to prevent the excessive use of current or unnecessary long connection of lamps to the networks, he advises the use of fittings which are provided with a counting device which always counts one more number, whenever the lamp is removed from the volts to be replaced by another one.—*Elek. Zeit.,* July 29.

Adelaide.—An illustrated description of the undertaking of the Adelaide Electric Supply Company in Port Adelaide, Australia. The system of distribution within the city is the three-wire, continuous-current system with a pressure of 400 volts between the outers, and the suburban portions supply by means of single-phase alternating current. The present direct-current installation consists of two 200-kw steam generators, one 850-kw turbo-generator and two 750-kw steam generators. Two 100-kw steam balancers and one 30-kw motor balancer are also installed. In the suburban single-phase distribution system concentric feeders at 2000 volts are run underground, on the solid system, to a number of transformer substations placed beneath the pavements. Secondary distribution on the three-wire system with 400 volts between the outers is carried out entirely above ground by means of bare, hard-drawn copper cables, supported on poles.—Lond. *Elec. Review,* Aug. 6.

German Central Station.—ROENTSCH.—A description of the municipal central station of the sity of Lehe, in the Province of Hanover, in Prussia. There are three steam engines, two of 150 hp to 200 hp each and the third of 330 hp to 440 hp. These are directly coupled with three shunt dynamos. Since they are used both for lighting and for traction, the voltage can be regulated in the limits of from 440 to 550 $\pm$ 6 per cent. For charging the storage battery a 60-kw booster is used, the voltage being adjustable from 50 to 300 with a number of 350 r.p.m. to 650 r.p.m. The booster is provided with interpoles and also with a compensating winding. The storage battery has a capacity of 648 amp-hours.—*Elek. Anz.,* July 22.

London.—The annual report of F. Sumner, the engineer to the City of London Corporation, deals, among other things, with street lighting and overhead wires. There are now 398 "open" arcs in the city of London, costing $130 per lamp per annum, and, in addition, 34 flame arcs and 18 enclosed arcs, all of which are used in connection with the experimental lighting. The number of private owners of overhead wires is now 137 and the number of companies 23, there being now a total of 733,828 spans.—Lond. *Elec. Eng'ing,* July 29.

Speed Regulation of Direct-Current Motors.—A note on a recent British patent of the British Thomson-Houston Company and E. Garton (14,700, 1908; July 29, 1909). The inventors describe means for keeping the speed constant with varying line pressure. A centrifugal governor driven from the motor shaft controls a contact, which, by means of a differentially wound relay, intermittently short-circuits a resistance in the shunt-field circuit of the motor. At normal speeds the resistance remains in the shunt-field circuit, but should the speed rise, a coil of the relay is energized and an armature moves, causing the resistance to be short-circuited. When the speed has fallen, the contact is broken and the resistance reinserted.—Lond. *Elec. Eng'ing,* Aug. 5.

Electrophysics and Magnetism.

Potential Drop at Surfaces of Glowing Carbon.—J. A. POLLOCK, A. B. B. RANCLAUD AND E. P. NORMAN.—Owing to the projection of ions by hot substances, a discontinuity of potential will occur at the surfaces of the electrodes in any circuit in which these latter are formed of heated materials. In a circuit with one heated electrode in air at ordinary pressure, the projection of ions from the hot surface necessitates the establishment of a potential difference between the electrodes if the current in the circuit is to be zero. The author has determined experimentally the potential differences for zero current as function of the temperature, the result being given in a diagram. In all cases the hot carbon was positive to the cooler electrode for zero current. On the basis of these results he deduces that the velocity with which electrons are projected from glowing carbon varies from 1.5×10^8 cm per second at 3375 deg. absolute to 2.5×10^8 cm per second at 3690 deg. absolute. In a similar way, a lower limit to the velocity with which electrons are projected from the Nernst filament is calculated at 3×10^7 cm per second.—*Phil. Mag.,* August.

Low-Temperature Experiments in Magnetism.—G. GRAY AND H. HIGGINS.—An abstract of a paper read before the Royal Society of Edinburgh. A description is given of experiments carried out on steel wire, special hard steel and manganese steel by alternate cooling with liquid air and warming. The experiments resemble those of Dewar and Fleming, except that the specimens were magnetized at the temperature of liquid air, and the results are very striking. Various experiments were made especially with manganese steel.—Lond. *Electrician,* July 30.

Electrochemistry and Batteries.

A Transition Point in Zinc Amalgam.—H. S. CARHART.—A paper read before the Physical Society of London. The paper gave the preliminary results of an investigation which has for its primary object the determination of the heat of dilution of zinc amalgams. This heat of dilution is negative—that is, the dilution of zinc amalgam by the addition of mercury absorbs heat. The method employed was electrical, by means of a concentration cell, the only difference between the two legs of the cell of H-form being in the concentration of the amalgam composing the electrodes. The ratio of the zinc to the mercury, expressed as a percentage, was in every case twice as great in one leg of the cell as in the other. This relation was secured by weighing out pure mercury in two portions, as one to two, and depositing in them the same quantity of zinc electrolytically by connecting the two in series with anodes of pure zinc, and both in series with a silver conductor. The operation was conducted in an atmosphere of hydrogen, and the concentration cell was exhausted of air and filled with hydrogen to avoid oxidation. Such a concentration cell is reversible and the Gibbs-Helmholtz equation applies to it. By measuring the e.m.f. at a known temperature and by determining the temperature coefficient of the e.m.f., the equation gives the heat of dilution in passing from no concentration to one-half. At a concentration of 2.3 per cent there is an abrupt change, which, according to the author, indicates a transition point in the zinc amalgam.—Lond. *Electrician,* July 23.

Resistors for Heating.—A note on a recent British patent (6106, 1909; July 29, 1909) of G. Cooper and F. C. Sharp, for resistance elements, particularly adapted for heating and cooking apparatus, and consisting of a thin metal strip wound spirally on a porcelain bobbin, the turns being insulated from each other by asbestos tape, also wound spirally. The width of the tape may also be less than the width of the metal strip.

so that the radiation at the edges may be increased.—Lond. *Elec. Eng'ing*, Aug. 5.

Units, Measurements and Instruments.

Temperature Errors in Shunted Ammeters.—Various communications by E. F. Moy, C. H. Wright, K. Edgcumbe and others with respect to the recent article by Fennell on temperature errors in shunted ammeters. Moy thinks that the material used for resistance strips in the shunt should be carefully selected so as to prevent the production of thermo-e.m.fs. He advises the use of manganin, which does not form a thermo-couple with brass or gun metal, and which is besides quite suitable on account of its low temperature coefficient of resistance. Fennell thinks, however, that the high heating of the shunt at one end was not thermo-electric, but due to a bad contact. Edgcumbe describes a simple arrangement by which thermo troubles can be avoided in shunts. The arrangement is shown in Fig. 2, where *CC* are the end blocks, *D* the shunt strip, and

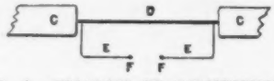


FIG. 2.—DIAGRAM OF ARRANGEMENT.

EE the two strips or wires of the same material as *D*. Into the ends *FF* of these the connections leading to the instrument are either soldered or clamped. Whatever the temperature difference between the two ends of *D* (on which alone the error depends) the points *FF* will both be practically the same temperature, and since the circuit *FEDEF* is composed throughout of the same material, the resulting e.m.f. will be dependent solely on the difference of temperature between the points *FF* and will consequently be zero, so that the ammeter remains unaffected. While, theoretically, the wires *EE* should be attached direct to *D*, the error introduced by fixing *E* into the block *C* instead of to *D* direct is extremely small, since, in the first place, *C* and *D* will not differ much in temperaure, and, in the second, the difference, whatever it may be, is very largely compensated by the similar difference which exists at the other end of the shunt. It is, moreover, immaterial whether the shunt consists of one strip, as shown in the figure, or of several. In a switchboard instrument no compensation is, as a rule, found necessary, owing to the extreme smallness of the e.m.fs. produced. For many purposes, however, such as portable instruments, where the contact surface is often deficient owing to the cables used, and still more for potentiometer work, where the e.m.fs. to be measured are frequently very small, such thermo-e.m.fs. are of considerable importance and have to be eliminated. Two courses are open, one being to use manganin for the shunts and the other to adopt the simple method of compensation described above.—Lond. *Electrical Review*, July 9, 16 and 23.

Photometry of Differently Colored Lights.—Various communications with reference to the paper by L. Wild, abstracted recently in the Digest. L. Lauriol refers to tests made by himself when comparing a Nernst lamp and an ordinary carbon lamp: (1) With the same photometer, when the distance of both lamps from the screen was varied, the relative value of one lamp to the other varied 20 per cent. (2) With the same distance, and with the flicker photometer, the relative value also varied 20 per cent according to the method of using the photometer: (a) with the disk moving at about 10 to 15 revolutions per second and the photometer really acting as a flicker photometer; (b) with the disk at rest, and the photometer acting without flicker, like any photometer of the equality of brightness type. J. Abady (inventor of a flicker photometer) does not find anything in Wild's figures in the nature of a proof that for testing tungsten lamps the flicker photometers will have to be discarded in favor of the Bunsen disk. "Those of us who have studied the question know perfectly well that photometer heads constructed on the contrast or equality-of-brightness principle will give different results from the flicker photometer, and this is on account of the color difficulty." L. W. Wild replies that the reason why he prefers to go by the results of a Bunsen or a Lummer photometer rather than the flicker photometer is that with the former the conditions are nearer to those of practical illumination. He also offers a physiological explanation why the flicker photometer gives incorrect results.—Lond. *Electrician*, July 30 and Aug. 6.

Unit of Candle-Power.—C. C. Paterson.—His paper read before the Physical Society, of London, on the proposed new international unit of candle-power. An abstract of this paper has already been noticed in the Digest.—*Phil. Mag.*, August.

Telegraphy, Telephony and Signals.

Egnér Holmström Telephone Apparatus.—Some notes on recent progress made in long-distance telephony by two Swedish telephone engineers, Egnér and Holmströmer. The essential principle of their system is the use of a special microphone capable of standing greater current strength than usual, as this increases the distance over which telephonic conversation can be carried on. The experiments carried on in Sweden have given the following results as to the respective capacity of the ordinary Swedish State telephone apparatus and that of the Egnér-Holmström type:

	Longest distance in kilometers with ordinary State telephone apparatus.	Conversations carried on through the new apparatus over the following distances in kilometers.
With 3-millimeter copper-wire line.....	1000 to 1200	2000
With 4.5-millimeter copper-wire line.....	1800 to 2000	4000
With 3-millimeter iron-wire line.....	180 to 200	400

In all these experiments the microphone current used for the new apparatus was from 1 amp to 1.25 amp.—Lond. *Engineering*, July 16.

Submarine Telegraphy.—S. G. Brown.—An illustrated paper read before the Royal Institution, in London, on the fundamental principles of modern submarine telegraphy. The author explains the time rate of signaling as determined by the K. R. law, gives data on the resistance and capacity, etc., of various cables, discusses the attenuation in a cable, and the method of duplex working, and then describes receiving and transmitting instruments, dealing especially with the progress made by the invention of the drum-cable relay and the magnetic shunt. He finally gives some notes on experiments made in 1908 with his high-speed system of working. With the new method, using a special relay, traffic has been carried continuously duplex at 230 to 240 letters per minute. "The principle of operation is as follows: When a submarine cable is forced beyond its normal speed of working the quick-changing signals, such as make up the letter C, are the first to fail, or, in other words, do not arrive with sufficient strength to work the receiver. It was found on trial that allowing more of the current from the cable to flow through the receiver—say, by increasing the size of the receiving condenser—the first and last signal of a series of reversals could be obtained with sufficient strength to work the relay efficiently. The relay, once started, is arranged to bring in fresh energy from its local battery, through a special retarding circuit, to add to the strength of the quick-changing currents on its own coil and thus the reversals are made strong enough to give a good record, which without this aid they would have been unable to do. By these means weak signals are built up at the receiving end of the cable, and the speed of working can be thus materially increased. It is fortunate that the class of signals that has the greatest difficulty in getting through the cable is the easiest to be added to when received. The "high-speed" relay works, therefore, not from the signals received from the cable only, but also from those that it transmits through its own local circuit, the record that it makes being the combined action of the two."—Lond. *Electrician*, July 30 and Aug. 6.

Transmitting Photographs and Drawings into the Distance.—L. Semat.—A paper presented before the French Academy of Sciences on the "Teleautocopist" of L. Semat, made by F. Ducretet and E. Roger, in Paris. The object is to transmit writings, photographs and drawings over a transmitting line without the use of selenium or photographic apparatus. There

are two revolving rolls, one at the transmitting end and the other at the receiving end. Both are of different diameter, but if the transmitted picture shall have the same size as the original picture, both rolls have the same length. On the smaller roll of the transmitting apparatus a metallic film is wound on which the picture to be transmitted is imprinted, or inserted in some other way, so that the picture covers the whole surface of the cylinder. The black lines of the drawing are electric insulators. A stylus touches on the cylinder and closes the circuit whenever it is in contact with the metallic film. The circuit is opened when the stylus gets in contact with the insulating black lines of the drawing. The roll on the receiving station has a larger diameter, and on it is wound a sheet of carbon paper and above it a sheet of ordinary paper. If the surface of the smaller cylinder is seven-eighths of the surface of the larger one, the reproduced picture on the larger cylinder will cover only seven-eighths of its surface. The speeds of the two rolls are in the reverse ratio of the surfaces—that is, the small

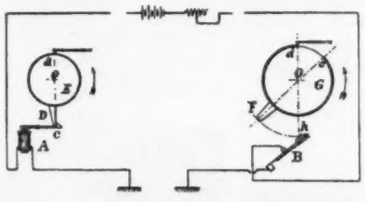


FIG. 3.—DIAGRAM OF CONNECTIONS.

roll completes a full revolution within seven-eighths of the time of the revolution of the larger roll. Moreover, the small roll, whenever it has completed a revolution, stops to revolve. It begins to revolve again only after the larger roll has completed its revolution. If a picture is to be reproduced in larger or smaller size the dimensions of the rolls must be correspondingly changed. The apparatus can be connected to ordinary telegraphic or telephonic lines, requiring no skilled labor The connections for producing synchronism are shown in Fig 3. The left side shows the transmitting station and the right side the receiving station. The electromagnet *A* attracts the armature, which arrests the pin *D* of the roll *E* as long as the electromagnet is excited. In the receiving station the interrupter *B* breaks the circuit whenever the pin *F* (inserted on the roll *G*) makes contact with *B*. The diameter of *E* is smaller than that of *G*. The angular speed of *E* is higher than that of *G*, so that the smaller roll *E*, whenever it has completed a revolution comes to rest because pin *D* is being held by the catch *c*. The roll *E* remains at rest until the larger roll *G* has completed its revolution, when the pin *F* acts on the interrupter *B* and breaks the circuit so that the electromagnet *A* is now without current and its armature releases the pin *D* of the roll *E*.—*L'Industrie Elec.*, July 10.

Wireless Telegraphy.—Count Arco.—A long and sharp reply to von Lepel on the question of priority of invention of the new Telefunken system.—Lond. *Electrician*, Aug. 6.

Miscellaneous.

Drawings.—A. Lang.—The writer endeavors to show that the present German laws are sufficient to protect the property rights of an engineer in his drawings against undesired reproduction, etc.—*Elek. Zeit.*, Aug. 5.

NEW APPARATUS AND APPLIANCES

Bryan-Marsh Salesmen's Association.

The annual business meeting and outing of the Bryan-Marsh Salesmen's Association was held at the Spring Lake Hotel, on Spring Lake, near Grand Haven, Mich., on Aug. 1 to 7, inclusive. There were 22 persons present, including visitors, factory managers and salesmen of the Bryan-Marsh Company. Morning and afternoon sessions were held, and a number of papers were read. Mr. J. L. Barnard, of the Minneapolis office, was elected president of the association; Mr. W. H. Reker, of Chicago, secretary, and Mr. J. S. Corby, of Chicago, treasurer and commissary. The delegates were quartered in a large cottage near the hotel, and there were baseball games, fishing, sailing, bathing and other outdoor sports after 3 p. m., when business was over for the day. Instruction and recreation were mingled pleasantly.

Indiana Electric Light Convention Commercial Notes.

While there were few exhibits at the meeting last week at French Lick Springs, there was a considerable attendance of commercial men. An interesting exhibit was made by the Shelby Electric Company, of Shelby, Ohio, represented by Henry W. Strock and W. H. Myers. It included both carbon and tungsten incandescent lamps. The Shelby lamps are used in the hotel, and Mr. Strock had a temporary dark cabinet arranged where he displayed the comparative light-giving qualities of a Shelby 16-cp carbon lamp and of another lamp of the same type and rating made by another manufacturer. In the same room was an exhibit of Holophane shades and reflectors, including the new reflectors for factory lighting, made by Charles A. Howe, manager of the Chicago office of the Holophane Company. Mr. Howe demonstrated the flux-of-light method of determining the required illumination for rooms. He also gave color tests to demonstrate the daylight quality of tungsten light and showed a new type of sign for show windows which conceals the lamps, reflects light on the goods displayed and at the same time serves as a sign with translucent letters in an opaque background.

The General Electric Company had eight representatives at the convention, the delegation comprising E. E. F. Creighton, Schenectady; Geo. C. Osburn, Harrison, N. J.; J. W. Dunbar and Oscar Camman, Cincinnati; J. R. Farrell and P. Worth, Indianapolis; H. C. Houck and C. P. Murchison, Chicago. Visitors at "G. E." headquarters were hospitably entertained.

The Westinghouse men present included J. C. Henderson, of Indianapolis, and F. O. Kirkpatrick, of Cincinnati, for the Westinghouse Electric & Manufacturing Company, and M. L. Spaulding, of Cincinnati, for the Westinghouse Lamp Company.

Other manufacturers and supply dealers were represented as follows:

Allis-Chalmers Company.—R. C. Sueve, Cincinnati.

F. Bissell Company.—M. E. Townsend, Toledo.

Brilliant Electric Company.—H. H. Cudmore and Arthur M. King, Cleveland.

Central Electric Company.—W. H. Pearl, Chicago.

Duncan Electric Manufacturing Company.—Adrian Tobias, Lafayette.

Electric Appliance Company.—Perry R. Boole, M. S. Walker and J. H. Bell, Chicago.

Fort Wayne Electric Works.—J. E. Hall, Fort Wayne.

General Incandescent Lamp Company.—Harry C. Rice, Cleveland.

Illinois Electric Company.—J. W. Kampman, Chicago.

Indianapolis Belting & Supply Company.—A. L. Wright, Indianapolis.

Monarch Electric Company.—Thos. H. Gage, Chicago.

Monarch Electric & Wire Company.—A. D. Gillespie, Chicago.

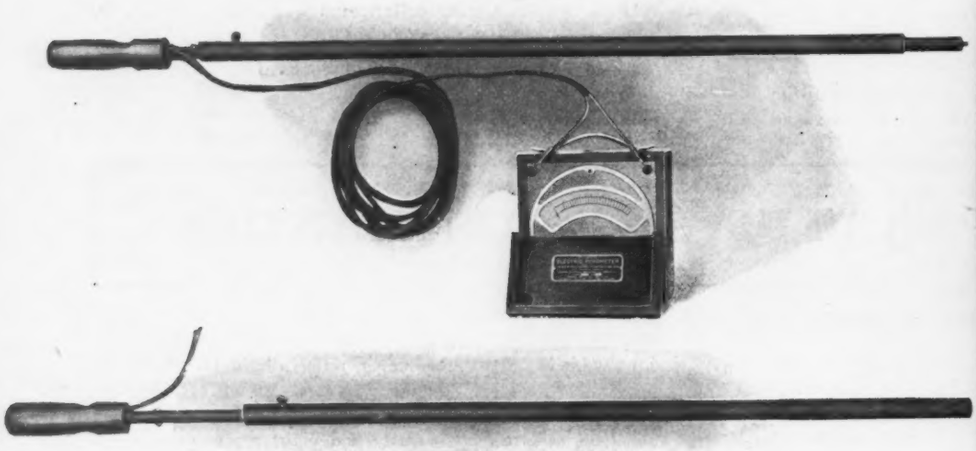
W. G. Nagel Electric Company.—L. F. Carney, Toledo.

National Carbon Company.—J. F. Kerlin, Cleveland.

Portable Electric Pyrometer for Quick Readings of High Temperatures.

A new quick-reading form of the Bristol pyrometer has been designed, consisting of a compound thermo-electric couple used in connection with a special portable instrument equipped with a pivot jewel-bearing Weston movement. The complete outfit is shown in Fig. 1. The thermo-electric couple is shown externally in Fig. 2. Fig. 1 shows the couple with the protecting sheath pulled back against a stop leaving the tip of the thermo-couple exposed. When a reading is to be taken with this special thermo-couple, it is inserted into the furnace or kiln, as shown in Fig. 2, with the tip protected from mechanical injury, and the iron pipe protecting sheath is then slipped back so that the tip is exposed to the hot gases whose temperature is to be measured. After a reading has been taken the couple is quickly withdrawn and partially cooled off before another reading is taken.

This form of couple is the invention of Prof. William H. Bristol, formerly of Stevens Institute, and now president of the Bristol Company. The compound construction of the element is shown in Fig. 3. The point *A* corresponds to the regular junction of an ordinary thermo-couple, and the two elements which join at the point *A* are platinum and platinum-rhodium, this being the particular couple selected as a standard by the German Government. The platinum and platinum-rhodium elements extend to the points *B* and *C*, where they are welded to two other wires made of inexpensive alloys so selected that the e.m.fs. generated at *B* and *C* are practically equal and opposed when these junctions are both exposed to temperatures not higher than 1200 deg. Fahr. These inexpensive alloy elements are extended to the point *D*, which is the cold end of the couple.



FIGS. 1 AND 2.—ELECTRIC PYROMETER.

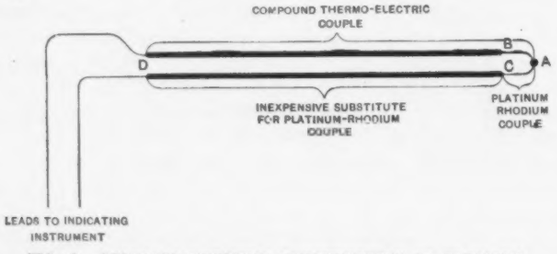


FIG. 3.—DIAGRAM SHOWING CONSTRUCTION OF ELEMENT.

This construction of the quick-reading couple is such that the platinum-rhodium tip of the couple *A* may be exposed to excessively high temperatures, up to 3000 deg. Fahr., without having the temperature of the junctions *B* and *C* exceed a safe limit. The temperature at *A* may be quickly measured with this special couple, as the platinum-rhodium tip is exposed directly to the hot gases in the furnace or kiln. In this way an inexpensive substitute is provided for the expensive platinum-rhodium couples previously employed for the measurement of such high temperatures.

The manufacturers of this instrument state it has been tested under very severe conditions and found extremely valuable for such applications as brick-kiln temperatures, boiler furnace fire-box temperatures, by-product coke-oven combustion flue temperatures, soaking-pit temperatures, etc. The complete outfit is portable, and readings of temperatures in the neighborhood of 2500 deg. may be obtained in a very few seconds after inserting the tip of the couple to the point where the temperature is to be measured. By using a special form of the platinum and platinum-rhodium tip this type of thermo-couple can be used to measure the temperature of red-hot surfaces of metal or other material.

Motor-Controlling Panels.

In the accompanying illustrations are shown motor-controlling panels with devices for varying both the armature and field-circuit currents. Fig. 1 illustrates a starting panel equipped with a no-voltage release device, an interlocking overload circuit-breaker and a field-circuit rheostat for a 2-to-1, 3-to-1 or a 4-to-1 speed variation. On the panel for larger motors the main circuit double-pole switch is replaced by two single-pole circuit-breakers. These panels are built by the Ward Leonard Electric Company, Bronxville, N. Y.

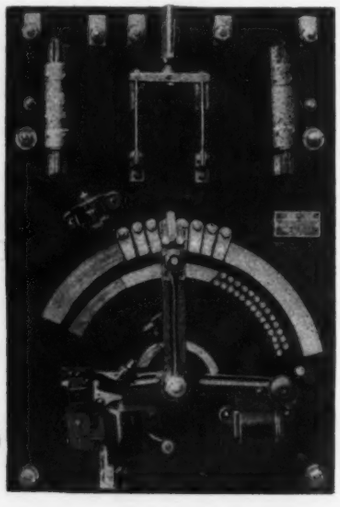


FIG. 1.—MOTOR-STARTING PANEL.

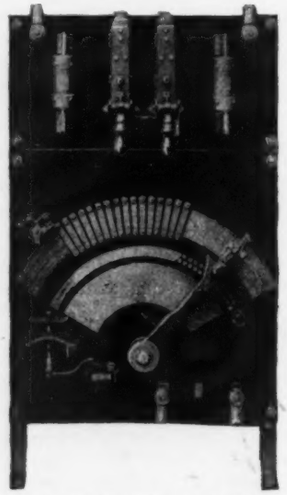


FIG. 2.—PANEL FOR LARGE MOTORS.

Blake-Knowles Multi-Current Feed-Water Heater.

In the matter of feed-water heating it has been convincingly demonstrated that to attain the highest efficiency the heating steam and the water to be heated must be kept in motion at a considerable and uniform speed and that the changes in direction of flow shall result in counter currents of steam and water in close contact and so directed as to compel the greatest transfer of heat possible. The accompanying illustration shows a heater in which these principles are embodied, made by the Blake-Knowles Steam Pump Works, New York.

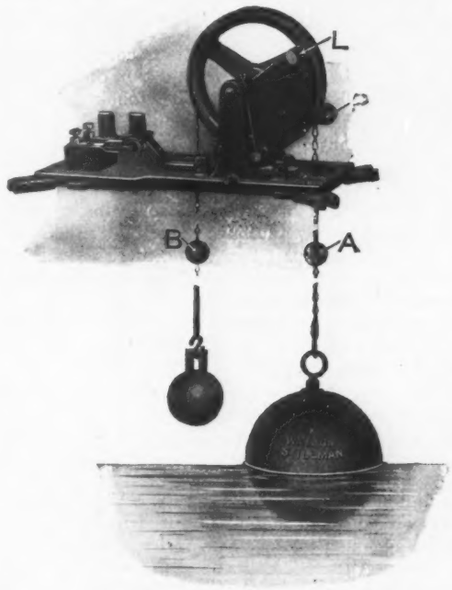
FEED-WATER HEATER.

The interior of the shell, through which the steam passes, is divided by longitudinal partitions in which the water-tubes are arranged so that the steam flows the entire length of the shell in close contact with these tubes three times before finally passing out. The water-tubes are expanded into the tube heads, one of which is a part of the main casting, while the other is bolted to a flexible diaphragm the periphery of which is fastened to the shell flange. This takes care of the tube expansion and makes unnecessary any troublesome stuffing boxes for the individual tubes. These water-tubes are of small diameter so that the heat passes quickly through the water, and six changes in direction of flow give the high water velocity essential for the best working results. Removal of the heater heads gives access to the interior, and the tubes are easily cleaned from the top end. These heaters are also made horizontal and are fitted with saddles in place of feet, as in the case of the vertical type.

Automatic Tank Switch.

The tank switch illustrated herewith is intended for service on top of the tank or sump cover, so as to permit any desired variation in water level to be automatically maintained without the necessity of relocating the electrical apparatus. Its operation in starting and stopping the motor is dependent upon the movement of a falling hammer, whose motion in turn is governed by a freely suspended copper float which is nearly counterbalanced by a cast-iron ball. Referring to the illustration of the interior mechanism, which is shown arranged for tank service, the two small wooden balls on the chain are adjustable and their position determines the variation of water level between operations of the pump. The switch is shown as when the pump is in operation. As the float rises, the ball *A* comes in contact with the projection *F* on the hammer and carries the latter past the center. The hammer then falls to the other side of the pulley shaft by gravity, and in so doing the lug *L* strikes a projection on the switch and disengages the knife, thus stopping the motor by interrupting the circuit. The switch movement is quick to avoid unnecessary arcing, and since the hammer remains in contact with the switch arm there can be no rebound.

The switch is held in the open position by the hammer until the water in falling to a lower level brings the other wooden ball *B* into contact with the hammer lug, which reverses the hammer, throws the knife into contact and starts the motor again by completing the circuit. The wheel acts merely as a carrier for the copper chain and plays no other part in the operation of the switch. As arranged for draining sumps, the copper float and iron ball are reversed in position so as to reverse the switch action and cause the pump to start when high water prevails. The knife arm is thoroughly insulated from every other part of the switch mechanism, and the two contact points are mounted on slate. A suitable opening is provided in the body for inserting the tube and making the connection to the binding posts.



AUTOMATIC TANK SWITCH.

The shaft is constructed of bronze and the working parts are enclosed in an iron case to protect them from the elements and from injury. The switch is made in both single-pole and double-pole pattern by the Watson-Stillman Company, of New York City.

Sterling Salesmen in Session.

The annual convention of the salesmen and office managers of the Sterling Electrical Manufacturing Company was held on Aug. 4, 5 and 6 at Warren, Ohio, the headquarters of the company. There were about 30 company men in attendance, drawn from different parts of the country. Daily meetings were held in the open air under the trees on the nursery farm of Mr. William Coale, treasurer of the company, where luncheon was also served.

The meeting was notable for the number of papers read and the close attention manifested in the discussions during the three-day convention. All branches of the incandescent lamp business, including design, manufacure and marketing, were up for discussion. On the evening of Aug. 5 Mr. C. E. Davidson, of the Holophane Company, delivered a lecture on the applications of Holophane glassware. Mr. J. Robert Crouse, of the National Electric Lamp Association, addressed the gentlemen present on Aug. 6. On the afternoon of that day the party was driven to a farm about three miles out in the country, where an old-fashioned chicken dinner was served. In the evening there was a stereopticon lecture at the Grand Theater, Warren, given by Mr. P. F. Bauder, of Cleveland. This lecture was similar to one given at the recent Atlantic City convention of the National Electric Light Association, by Mr. Bauder, and gave the result of the speaker's researches into the color values of various illuminants. A number of citizens of Warren and Niles attended this lecture, and the hall was filled with an attentive audience. The convention was accounted a successful one in every respect.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The improvement in trade conditions continues as the vacation season draws to a close and completion of harvests gives to the producers definite results. The jobbing and wholesale cereal trade reports a healthy expansion of business, and buyers' excursions to various trade centers have done much to stimulate orders, especially for dry goods, clothing, shoes and hardware. While trade is thus showing improvement, there is no indiscriminate rush of buying. From almost every market comes the report that, while buyers are taking hold better than at any time during the past two years, there is still a sentiment of conservatism and caution. Purchases are carefully considered and are rigidly limited to safe amounts. The lesson of the recent period of depression seems to have been more deeply instilled than that of any similar period which has gone before. In the industrial world there continues to be a distinct improvement. Orders are still running heavy and more workmen are being employed. In iron and steel the mills are constantly advancing prices, and premiums are being required for prompt deliveries. Structural material continues to be in heavy demand, and the railroads are purchasing cars and locomotives quite freely. About 20,000 tons of steel rails were ordered last week for delivery before the end of the year, and inquiries are said to be numerous for delivery early in 1910. Although collections are reported to be somewhat better, they are still not up to what the improved conditions of trade would seem to warrant. It is believed that as soon as crops begin to move to market more freely there will be much prompter payments. Business failures for the week ended Aug. 19, as reported by *Bradstreet's*, were 183, compared with 219 the previous week, 236 in the same week of 1908, 153 in 1907, 155 in 1906, and 176 in 1905.

THE COPPER MARKET.

There has been so little doing in the copper market during the past week that it would be impossible to attribute to it any definite character. Trading has been extremely light, and buyers, both for speculative accounts and for consumption, have been very scarce. In spite of this stagnation selling prices have been fully maintained, and at the close of the week transactions on the Metal Exchange were at figures fractionally in advance of those a week previous. The statistical position of the market is but little more encouraging in spite of the heavy reduction of stocks in producers' hands, shown in the association's figures for July. Production continues on a record basis and the actual melting is still more or less curtailed. The remarkable deliveries of July are regarded as a freak of trade not likely to be soon repeated, and it is recognized that consumers must have accumulated stocks far beyond their immediate needs. What figure these accumulations will cut in the future demand remains a question. During the past week the London market has been extremely unsettled and prices have fluctuated. This has done much to cause buyers on this side to hesitate and consider it wise to await developments. Exports for August will probably be 10,000 tons less than for July. Up to and including Aug. 23, they were 15,091 tons. The daily call on the Metal Exchange at 12.30 o'clock, Aug. 23, quoted standard copper as follows:

	Bid. Per lb.	Asked, Per lb.	Settling price, Per lb.
Spot	12.75	13.00	.....
August	12.75	13.00	12.87½
September	12.75	13.00	12.87½
October	12.75	13.00	12.87½
November	12.80	13.05	12.92½
December	13.00	13.10	13.05..

Prices in the London market Aug. 23 were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	59 15 0	59 13 6
Standard copper, futures	60 13 9	60 12 6
Market	Firm	Steady
Sales of spot		500 tons
Sales of futures		1,600 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.00	12.62½
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

LIGHTING PLANT FOR GROTON, MASS.—The town of Groton, Mass., has determined to construct a distribution system for lighting. Energy will be purchased from the Ayer Electric Light Company, which is owned by the Massachusetts Lighting Companies. The plant will cost $15,000, and the city will use 180 32-cp tungsten lamps for street lighting. The commercial rate to consumers will be from 15 to 18 cents per kw-hour.

SOUTH CAROLINA ELECTRIC POWER & MANUFACTURING COMPANY.—It is reported that the Electric Power & Manufacturing Company, which has an extensive hydro-electric plant at Gaston Shoals, S. C., is now negotiating for the purchase and development of another water-power site in the same section. This company, which owns the Spartansburg Railway, Gas & Electric Company, and which furnishes energy to the municipal light and power plant at Gaffney, S. C., is said to be interested in the development, by merger and construction, of an extensive interurban trolley system in the northern section of South Carolina. It will also furnish energy to a number of cotton mills in that neighborhood.

CIPHER TELEGRAPH RATES ADVANCED.—The Western Union and Postal Telegraph companies have announced a new schedule on cipher messages, to become effective Sept. 1, which will result in a material advance in rates. Under the new schedule all messages not composed of ordinary words found in the dictionary will be charged for at the rate of five letters to the word, instead of 10 as at present. This schedule refers to domestic messages only. As explained in the issue of Aug. 12, the cable companies have already determined to eliminate impossible words in cipher cablegrams. It is explained that the telegraph companies have been forced to this policy on account of the difficulty of handling the increasing number of code messages.

LIGHTING CARBONS STILL IMPORTED.—The importers of lighting carbons say that they have no intention of going out of business on account of the increase in tariff duties under the new tariff schedules. One importer, who took an active part in the fight before the Ways and Means Committee to secure lower rates, had this to say about the future of the business: "I not only am not discouraged, but I am doing more business at present than ever before. I have just sent out to central station managers throughout the country 3000 circular letters advising them to make no contracts for carbons without having first consulted us on terms. I may be in a more fortunate condition than some of the other importers on account of the differential in price made on single length carbons by the German factory I represent. It is possible for me to get in New York 1000 single-length carbons very much cheaper than I could formerly get 500 double-length carbons, and while I only paid a duty of 45 cents per hundred feet formerly and now pay 65 cents, the difference in first cost and the elimination of the rehandling cost practically offset the increase in duty. I will not have to increase my prices under the new tariff."

INSULATED WIRE TRADE IMPROVING.—The demand for insulated wire is said by the manufacturers to be very much better at present than it has been at any time within the past year. The vast amount of building that was begun early in the spring is beginning to bring in returns to the wire men, and the number of inquiries being received indicates a very heavy trade in the fall. A representative of one of the leading concerns had this to say: "We are just feeling the benefits of the boom in building. Orders are coming in rapidly and there is a prospect for large business in the fall. We are very well satisfied with present conditions and are enthusiastic about the future."

NEW CANADIAN RUBBER AND INSULATION PLANT.—The factory of the Walpole Rubber Company, Ltd., which has been incorporated with a capital of $250,000, at Granby, Quebec, is nearing completion; the general sales offices are in the Eastern Township Bank Building in Montreal. The officers and directors of this new company are for the most part officers and directors of the Massachusetts Chemical Company, operating the Walpole Rubber Works, the Walpole Varnish Works and the Walpole Shoe Supply Works, at Walpole, Mass., U. S. A. The Walpole Rubber Company, Ltd., of Canada, will operate upon similar lines to the parent company, producing all kinds of rubber splicing, insulating and friction tapes, and miscellaneous rubber sundries, together with the well-known varnishes and insulating compounds, such as armalac, insulac, the Walpole hot-water bottles under the Gleason fusible core process, the "cat's-paw" rubber heels, etc. The growth of the business of the Massachusetts Chemical Company, and the ever-increasing demand from all parts of Canada for the products named, necessitated the establishment of a manufacturing equipment in the Dominion to properly care for and encourage it. The city of Granby, aside from being the home of one of the directors, offers exceptional inducements for such an enterprise, furnishing an excellent water-power sufficient for all factory purposes and unexcelled shipping facilities.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—The entire force of the Westinghouse Electric & Manufacturing Company at East Pittsburgh was placed on full time last week, and is now working 10 hours a day. Heretofore a majority of the workmen were employed only eight hours. A representative of the company states that at the present time there are between 10,000 and 11,000 men on the payrolls, as compared with 6000 at the low point last year. The gross business is now running at about $2,500,000 per month, or $30,000,000 per year. During July the business was $3,000,000, but this is recognized as being above the average. The foreign companies are also making excellent returns. In connection with this increased business, there has been a renewal of the talk of the early resumption of dividends. It is reported that the payment of the back dividends accrued on the preferred stock may be made in October, and that a 5 per cent dividend on the assenting stock may be paid early in 1910. When the reorganization plan was under discussion those who took the assenting stock at par were assured that dividends would be paid at the earliest possible moment.

GENERAL ELECTRIC COMPANY'S SALES.—Officials of the General Electric Company report that business is slowly improving, but that as yet the majority of orders are for small machinery rather than for heavy apparatus. Manufacturing plants all over the country are considering the introduction of electrically driven machines, and many inquiries are being made and many specifications being considered in this direction. Among the recent sales of the company in this territory are one 1500-kw rotary converter to the New York Central Railroad Company for lighting service in that portion of the new Grand Central Station which has already been completed. The energy will be obtained from the Port Morris power house. Other sales include an electrically driven installation, with 450-kw engine-driven generator, for the Firth Carpet Company, of Firthcliff, N. Y.; 500-kw turbo-generator for the Brighton Mills, at Passaic, N. J., and complete installation for the Standard Oil Company's plant at Montrose, N. Y. The demand for domestic appliances is said to be constantly on the increase.

ELECTRICAL EQUIPMENT.—The new power plant of the Southwestern Portland Cement Company, El Paso, Texas, will contain two 600-kw Westinghouse steam turbo-alternators delivering 60-cycle, three-phase current at 440 volts. Excitation current is furnished by a 55-kw, 125-volt, engine-driven generator, and by a motor generator set comprising 55-kw and 20-kw direct-current generators driven by 115-hp induction motor. The turbines exhaust into Westinghouse-LeBlanc condensers, which maintain a vacuum of 28 in. The motor equipment of the mill comprises a number of three-phase 440-volt induction motors of both vertical and horizontal types and ranging from 5 to 100 hp. All motors were furnished complete with starting apparatus by the Westinghouse Company. The power plant of the Southwestern Portland Cement Company supplies lighting service in addition to operating the cement mill.

SUIT TO RECOVER WIRELESS PROPERTY.—Floyd N. Bradley, receiver of the International Wireless Telegraph Company, has instituted suit at Trenton, N. J., against the American De Forest Wireless Company to recover the assets of the International Company amounting, it is claimed, to $7,500,000, which the petitioner says, was transferred to the De Forest Company without compensation. As both of these companies are in practically a moribund condition, the suit is not regarded as very important by people who are interested in wireless telegraphy.

SUSQUEHANNA ELECTRIC POWER COMPANY.—The Susquehanna Electric Power Company, the $10,000,000 proposition which is now constructing a dam for a hydro-electric plant on the Susquehanna River, will, it is said, compete for the light and power business in the city of Baltimore. This company is the only one that has a right to enter the field against the Consolidated Gas, Electric Light & Power Company, which now holds a monopoly for distributing electric energy in that city.

TORONTO TO BUY ELECTRICAL APPARATUS.—The City of Toronto will receive bids until Oct. 14 for the following electric apparatus: Four 1500-hp synchronous motors, two 1500-hp induction motors, four 500-hp induction motors and two 225-hp synchronous motors, with exciters, switchboards and connections. Bids will also be received at the same time for a number of large-sized turbine pumps, piping, valves, etc.

CANADIAN PACIFIC ELECTRIFICATION.—It is reported that officials of the Canadian-Pacific Railway will shortly look into the possibilities of electrifying the Columbia & Western branch. It is stated that 35,000 hp is available at Bonnington Falls, while there are several other good water-powers along the line not yet developed. Lorne A. Campbell, Nelson, B. C., may be addressed on the subject.

EXTENSION OF FT. WAYNE WORKS.—Plans are under way for the construction and equipment of a four-story addition to the plant of the Ft. Wayne Electric Works, involving the expenditure of nearly a half million dollars. Part of the additional space is necessary for the manufacture of the Wood new style magnetite arc lamp, for which a large demand has developed.

THE HAWKS ELECTRIC COMPANY, Goshen, Ind., has added a department for the care of electric vehicles. For a monthly consideration the company will take care of all electric vehicles, including pleasure cars, light delivery machines and trucks, providing skilled attendance and service. The company has also taken an agency with the Woods Electric Company, of Chicago.

CALGARY HYDRO-ELECTRIC PLANT.—The Calgary Power & Transmission Company will shortly call for tenders for the construction of a power plant, 45 miles west of Calgary, and also for the erection of the necessary transmission lines. Smith, Kerry & Chace, consulting engineers, Toronto, Ont., have the plans.

LOCKE INSULATOR PLANT.—The insulator manufacturing plant of Fred. M. Locke, at Lima, N. Y., which was destroyed by fire several months ago, is being rebuilt and will be ready about the middle of September for the manufacture of insulators under Locke patents.

PORT HOPE, ONT., HYDRO-ELECTRIC SCHEME.—The Durham-Northumberland Power Company is completing arrangements for the development of extensive water-power rights in the vicinity of Port Hope, Ont. J. A. Culverwell is managing director.

NIPISSING HYDRO-ELECTRIC PLANT.—The Nipissing Electric Company, Ltd., is constructing a power plant 19 miles from North Bay, Ontario, to supply that town. Smith, Kerry & Chace, consulting engineers, Toronto, Ont., have the work in charge.

ARROW ELECTRIC COMPANY.—The Arrow Electric Company has purchased the entire capital stock of the Marshall Electric Company, of Boston, and that corporation will be operated under its management. No particulars relating to the purchase have yet been made public.

WINNIPEG MUNICIPAL PLANT.—Plans will be prepared at once for a line to distribute power from the civic plant now under construction. Address F. E. Cambridge, city electrician.

SALES OF "NEW AMERICAN" TURBINES.—The Dayton Globe Iron Works have recently received a contract from the United States Government for two 44-in. improved New American turbines, to be installed vertically in open concrete flumes, at the turbo-compressor plant, which the United States Government is erecting at Lock No. 5, Monongahela River. An order has also been received from the Beaver Valley Water Company, Beaver Falls, Pa., for its New Brighton station, for two vertical turbines, one a 51-in. wheel, and the other a 19-in. wheel, each complete with vertical and horizontal shafting, and bevel gears and arranged to direct connect to the pumping units. Other recent orders are for head gate work for the Twin Falls-Salmon River Land & Water Company, for installation at the Salmon River Dam, in Idaho. This consists of four cast-iron gates and frames, complete with specially constructed steel piers, each of the gates to be 2 ft. 6 in. wide by 10 ft. high, and will be operated at the controlling works for the outlet into the tunnel, and work under approximately 84 ft. head of water, the hoisting mechanisms being placed approximately 92 ft. above the bottom of the gates. Connell & Connell, engineers, of New York City, have ordered the complete head-gate hoisting mechanism for four 6 ft. by 17 ft. 6 in. gates, which will be installed in the hydro-electric plant now being built by the Uniform Fibrous Talc Company, at Gouverneur, St. Lawrence County, N. Y.

CAMPAIGN OF EDUCATION FOR TUNGSTENS.—Beginning with their September issues, all of the popular magazines will carry full-page advertisements from the General Electric Company setting forth the value and economy of tungsten lamps for household lighting. This is the opening gun in an extensive campaign that has been planned for the purpose of popularizing tungstens. In this campaign the General Electric Company intends to use only the popular press and will make its appeal direct to the consumer. The advantages and economy of illumination by tungstens will be fully explained, and readers will be advised to buy their lamps from the local lighting companies. It is proposed to continue the propaganda through the fall.

NEW ENGLAND COTTON MILLS ELECTRICALLY EQUIPPED.—The Allis-Chalmers Company has recently contracted to furnish the new Nashawena Mills, in New Bedford, Mass., with two 3000-kw and one 500-kw steam turbines. These mills were recently financed by William Whitman, and are now being equipped in the most modern fashion. The same company has also contracted with the Whitman Mills, of New Bedford, for power house equipment, including one 2000-kw steam turbine, and with the Byron-Weston Company, of Dalton, Mass., for 1750-kw steam turbine. The Allis-Chalmers Company has recently sold to New England cotton mills 27 steam turbines with an aggregate of 36,000 hp.

CONSUL DESIRES CATALOGS.—U. S. Consul Edwin S. Cunningham, Durban, Natal, Africa, asks us to say that he will be very glad to receive catalogs of American manufacturers, which will be carefully filed for permanent reference.

Financial Intelligence.

THE WEEK IN WALL STREET.

The past week in Wall Street was one of heavy liquidation, and in the case of the pronounced market leaders of serious declines. Out of a total sales of more than 6,000,000 shares, the four issues—Union Pacific, Southern Pacific, Reading and Steel common—footed up considerably more than half. In the case of Union Pacific and Steel the sales of each ran more than 1,000,000 shares. It is not necessary to go very far to discover the reason for the heavy breaks in these market leaders. As has been pointed out before, many of the leading stocks, in which speculation has been active for months, have been pushed to levels entirely beyond what is warranted by business conditions. Recent advances in these issues have been very rapid—unsafely rapid—a condition undoubtedly brought about by the enthusiastic speculative trailers who follow the great market leaders. The real strength of the market has been indicated by the fact that beyond the few speculative issues, no damage was done. One disquieting subject that was worked overtime during the early part of the week was the condition of Mr. Harriman's health. From a dying incurable to a restored Ajax, the rumor factories ran the gamut. As the great man neared the American shore, trading paused through sheer fear of commitments on the wrong side. In the meantime there continues to be a steady and legitimate business in bonds. Many limited issues, largely of public utilities, are daily appearing and are being eagerly absorbed by small investors. The money market has been stronger as the volume of trading increased, but at the end of the week under review was practically the same as at its beginning. Rates Aug. 23 were: Call 2¼@2½ per cent, 90 days 3¼@3½ per cent. The quotations in the table are those of Aug. 23.

NEW YORK.

	Aug. 16.	Aug. 23.	Shares sold.		Aug. 16.	Aug. 23.	Shares sold.
All.-Ch.	15½	15½*	1,240	Int.-Met., pfd..	46¾	46⅞	23,100
All.-Ch., pfd..	53⅞	53⅜	1,700	Mackay Cos...	83*	84	200
Amal. Cop.....	85⅜	85⅝	137,400	Mackay Cos.,p.	74½	74½*	252
Am. D. T.....	20½	20½*	67	Man. Elev....	143¾	142½	1,100
Am. Loc.....	65	63	22,220	Met. St. Ry...	24*	23	500
Am. Loc., pfd..	120*	116½	300	N.Y. & N.J.Tel.	141	140½	300
Am. Tel. & Cbl.	76*	76*	——	Steel, com....	76¾	77⅜	1,045,110
Am. T. & T....	141½	140⅜	18,100	Steel, pfd.....	125⅛	125	27,805
B. R. T.....	79	80½	42,565	W. U. T.....	74	73	3,250
Gen. Elec.....	169	169	5,100	West'h, com...	86	87¾	7,420
Int.-Met., com.	14¼	15	11,300	West'h, pfd...	130*	125*	200

PHILADELPHIA.

	Aug. 16.	Aug. 23.	Shares sold.		Aug. 16.	Aug. 23.	Shares sold.
Am. Rys.....	45⅞*	46½*	——	Phila. Elec....	12¼	12⅛	——
Elec. Co. of A.	12⅛	12⅛*	——	Phila. R. T....	30⅜	30¼	——
Elec. St. B'ty..	61¾	61	——	Phila. Trac...	91	90½*	——
E. S. B'ty,pfd.	49*	49*	——	Union Trac...	54½	54⅛	——

CHICAGO.

	Aug. 16.	Aug. 23.	Shares sold.		Aug. 16.	Aug. 23.	Shares sold.
Chi. City Ry..	180*	180*	——	Chi. Tel. Co..	135½*	135*	——
Chi. Rs.,Ser.1.	119½*	119½*	——	Met. El., com..	17¾	17¾*	——
Chi. Rs.,Ser.2.	37	37¾*	——	Met. El., pfd..	49*	49*	——
Com. Edison..	121*	120⅞*	——	Nat'l Carbon..	98	95	——
Chi. Sub'ws...	20½*	19½*	——	Nat'l C., pfd...	119*	120*	——

BOSTON.

	Aug. 16.	Aug. 23.	Shares sold.		Aug. 16.	Aug. 23.	Shares sold.
Am. T. & T...	141⅝	140⅜	——	Mex. Tel.....	2½*	2⅜*	——
Cum. Tel.....	142½	143*	——	Mex. Tel., pfd.	5¾	6¼*	——
Edison E. Ill..	252	252*	——	N. E. Tel....	137	137	——
Gen. Elec.....	169	166⅛*	——	W. T. & T....	11⅝	10¾*	——
Mass. E. Ry..	14⅛	14¼	——	W. T. & T., p.	81	89*	——
Mass E. R., p.	75	74	——				

*Last price quoted. Shares sold are for week Aug. 16 to Aug. 21.

DIVIDENDS.

American Railways Company, quarterly 1½ per cent, payable Sept. 15.

Blackstone Valley Gas & Electric Company, preferred, quarterly 1½ per cent, payable Sept. 1.

General Electric Company, quarterly 2 per cent, payable Oct. 15.

Mobile Electric Company, preferred, quarterly 1½ per cent, payable Aug. 16.

Northern Texas Electric Company, non-cumulative preferred, semi-annual 3 per cent; common, initial, 2 per cent; both payable Sept. 1.

Philadelphia Electric Company, quarterly 1½ per cent, payable Sept. 15.

Seattle Electric Company, common, quarterly 1¾ per cent; preferred, semi-annual 3 per cent; both payable Oct. 1.

HOME TELEPHONE COMPANY OF MICHIGAN.—The organization of the Home Telephone Company of Michigan has been completed at Detroit, with $5,000,000 capital stock and an authorized bond issue of $10,000,000. The new company proposes to take over the properties and business of the Home Telephone Company of Detroit and the Interstate Long Distance Telephone Company. A number of St. Louis, Mo., capitalists appear in the list of directors. Fred T. Moran, of Detroit, was elected chairman of the board, and W. A. Jackson, formerly president of the Michigan State Telephone Company, was elected president. The St. Louis directors are Albert N. Edwards, E. A. Faust, A. W. Lambert, M. F. Bayard, Bliss Michael, Henry Koehler, Jr., E. F. Goltra and Samuel D. Jeffries. The company is planning to expend $1,000,000 immediately on extensions.

YAKIMA CENTRAL HEATING COMPANY.—The Yakima Central Heating Company, capitalized at $100,000, of North Yakima, Wash., has been incorporated to do a central-station heating business. The company will build a plant having 800-hp boiler capacity, with feed-water heaters, boiler feed pumps, etc. The distributing system will require about 10,000 ft. of street mains, of from 4 to 10 in. diameter. Live steam will be used for heating, and customers will be charged on a metered basis at rates ranging from 75 cents to $1 per thousands pounds of condensation. The Schott Engineering Company, of Chicago, has the contract to install the complete plant, which will cost about $100,000.

EMPIRE DISTRICT ELECTRIC COMPANY.—The new holding company, known as the Empire District Electric Company, which was recently incorporated under the laws of Kansas to take charge of the interests now owned by H. L. Doherty & Company in the Joplin mining district, has made its formal offer of securities. The new company will acquire at once the properties of the Consolidated Light, Power & Ice Company, the Joplin Light, Power & Water Company, of Joplin, Mo.; the Galena Light & Power Company, of Galena, Kan., and 57 per cent of the stock of the Spring River Power Company, of Lowell, Kas. It is planned to build a 16,000-hp modern steam-turbine station to further supply the demands of the district in which the new company will operate. It is intended to supply energy for lighting the cities of the entire district, and also for street and interurban railways and for mining operations. As stated in last week's issue, the authorized capital will be $6,000,000 in bonds; $3,000,000 in preferred stock, and $3,000,000 in common stock. The immediate issue will be $1,250,000 of bonds; $500,000 of preferred, and $1,600,000 of common. The subscribers to the bonds at par are offered 25 per cent in preferred and 40 per cent in common stock as bonus. It is stated that the securities that are to be offered at present have already been oversubscribed, but that a small amount will be offered to the public, which originally had been purchased by the broker's firm of Williams, McConnell & Coleman, 60 Wall Street, New York.

ELECTRIC TRACTION IN TEXAS.—An unusually large number of street railway and interurban electric railway enterprises are on foot in Texas. One of the latest of these projects is that of the Medicine Mound & Quanah Electric Railway Company, which is preparing to build an interurban electric line 18 miles long, to run between Quanah and Medicine Mound. It is stated that the building of this road is practically assured. The electric street railway system in San Angelo, which has been in the hands of a receiver, has been taken over by the San Angelo Street Railway Company, having a capital stock of $100,000. The property consists of four miles of track and other valuable holdings. The new company will immediately build four miles of additional track and make other important improvements. Sam Crowther is at the head of the company. The Port Arthur Traction Company, which was recently organized with a capital stock of $200,000, is arranging to build an extensive system of street railway in Port Arthur, and to construct and operate interurban electric lines to points near that town. The chief stockholders of the new company are H. J. Myers, A. H. Reeder and S. M. Krohn, all of Dayton.

CLIFF ELECTRICAL DISTRIBUTING COMPANY.—The Cliff Electrical Distributing Company has petitioned the Public Service Commission, Second District, for permission to increase its capital stock to $500,000, and to issue $1,500,000 in mortgage bonds, and for approval of the transfer to it of that part of the franchise and works of the Niagara Falls Hydraulic Power & Manufacturing Company relating to the generating and distribution of electric power, in which part of the petition the latter company joins. The company was incorporated in order to separate the electrical development and distributing properties of the Niagara Falls Hydraulic Power & Manufacturing Company from its other properties, the latter company, besides its hydraulic canal in Niagara Falls for furnishing water for power purposes, owning two flour mills and various pieces of real estate not connected with the electrical generating and distributing business. A part of these properties is not subject to the Public Service Commission and its regulation, and hence the desire to put it under separate corporate administration.

WESTERN UNION GETS AWARD.—Everett W. Burnett, master appointed by the court to settle the dispute between the Western Union Telegraph Company and the American Telephone & Telegraph Company, has filed his report in the United States Court at Boston. He awards to the Western Union 20,087 shares of stock in 37 subsidiary Bell companies, and $2,579,914 in cash. This award is a reduction of 18,101 shares and of $3,293,377 in cash from the claim filed by the Western Union. The award excludes from the accounting 5000 shares of American Telephone & Telegraph, 3895 shares of New England Telephone & Telegraph, 200 shares of the Bell Telephone of Pennsylvania, 396 shares of Chicago Telephone Company and 8609 shares in various other companies. The officials of the American Telephone & Telegraph Company have recently expressed the opinion that this case was likely to be in the courts for another 10 years, so that it is not probable that the Western Union will collect this award in the near future. It is reported that a compromise and cash settlement are not unlikely.

AMERICAN TELEPHONE & TELEGRAPH STOCK EXCHANGE.—It is announced that the American Telephone & Telegraph Company is meeting with satisfactory success in the transfer of its stock for the shares of the Bell of Pennsylvania, the New York & New Jersey, the Bell of Buffalo, and the Central District Telephone Company of Pittsburgh. Up to this time more than 40 per cent of the outstanding minority stock in these companies has been turned in. The offer which the big company made to these four companies will expire Aug. 31, and it is announced that it will not be extended. The shareholders who hold off after that date will lose the opportunity to transfer their holdings. It is certain that the American will have practical control of all the companies by that time.

MICHIGAN PUBLIC SERVICE MERGER.—A. G. Hodenpyl, of Hodenpyl, Walbridge & Company, New York, says that the published report that a merger is being effected between the Saginaw Bay City Light Company, the Kalamazoo, Jackson and Pontiac gas properties, the Grand Rapids Railway Company, the Flint and Cadillac gas properties, and the water-power rights on the Sabule River, is premature. All of these properties are controlled by the Hodenpyl firm and E. W. Clark & Company, of Philadelphia. Mr. Hodenpyl says that some investigation as to the practicability of placing these properties under one management has been made, but that the matter is still in an embryonic shape, and probably will not be taken up for some months to come.

COMMONWEALTH EDISON COMPANY.—The stockholders of the Commonwealth Edison Company, of Chicago, have been called to meet on Nov. 9 to vote on a proposition to increase the capital stock of the company from $30,000,000 to $40,000,000. It is the present intention of the directors to offer $3,000,000 of the new issue to the present stockholders at par up to 10 per cent of their present holdings. The proceeds of the sale of this stock will be used to cover improvements and extensions. A new plant will be constructed on Fiske Street, and the present substations will be enlarged.

KANAWHA & OHIO VALLEY TRACTION COMPANY.—The Kanawha & Ohio Valley Traction Company has recently been incorporated under the laws of West Virginia, for the construction of a traction system from Kanawha Falls to Point pleasant, on the Ohio River, a distance of 150 miles. The preliminary capital of the incorporation is $100,000, but it is expected that the entire systetm will cost about $5,000,000. Former Governor F. P. Groscup is one of the incorporators. This new line will open up a large area of valuable mineral and timber land that is now without transportation facilities.

OTIS ELEVATOR COMPANY.—For the first half of the present fiscal year the sales of the Otis Elevator Company have been almost up to the high average made in 1907, which was the banner year in the company's history. During that year the company did a gross business of more than $15,000,000. It is altogether likely that this year's net earnings will run somewhat better than 10 per cent on the common stock. The present dividend rate is only 3 per cent, but this is likely to be increased in the Fall.

PACIFIC STATES ELECTRIC COMPANY.—The new consolidation on the Pacific Coast, which was started by the incorporation in July of the Pacific States Electric Company with a capital of $500,000, has practically consummated deals to take over the Pacific Electrical Works, Los Angeles; the Crescent Electric Company, Oakland, and the Sterling Electric Company, San Francisco. All of these concerns are dealers in electrical supplies and machinery.

LIGHT AND TRACTION MERGER PROJECT.—It is reported that the Union Gas, Electric Light & Railway Company, which controls the Evansville Gas & Electric Light Company, is making headway in project to effect a merger of its Evansville holdings with the Evansville & Southern Indiana Traction Company, and possibly with other traction interests entering Evansville.

PHILADELPHIA ELECTRIC COMPANY.—The directors of the Philadelphia Electric Company have authoritatively denied the report that they are considering making another call on the stockholders for $5 a share.

GENERAL NEWS

Construction News.

ANNISTON, ALA.—Application has been made to the City Council for a franchise by Col. William H. Zinn to construct a street railway system in Anniston.

BIRMINGHAM, ALA.—The City Council of North Birmingham has passed a resolution authorizing the sale of the North Birmingham water and light plants to James L. Cole and A. I. Thorpe for a consideration of $1 and the assumption of the bonded indebtedness, amounting to $190,000. The new owners agree to furnish the city of North Birmingham with street lamps at the rate of $50 per lamp per year and water hydrants at $35 each per year.

GLOBE, ARIZ.—A. H. Stern, representing Los Angeles capitalists, has petitioned the City Council for a franchise to construct a street railway in Globe, to be operated by electric or gasoline motors.

POLAND, ARIZ.—The Fairbanks-Morse Company has been awarded the contract for the complete equipment for the Poland Mining Company, at Poland.

PRESCOTT, ARIZ.—The Arizona Central Copper Company is reported to be in the market for new electrical equipment for the Shylock mine, which will include an electrical hoist, electrical pump and Temple drills. J. B. Cleveland is general manager.

PINE BLUFF, ARK.—The contract for electrical equipment and electrical wiring for the new seven-story bank and office building to be erected by the Citizens' Bank in this city was awarded to the Pine City Electric Company, of Pine Bluff, Ark.

MONETTE, ARK.—The Monette Lumber Company is reported to have applied for a franchise to install an electric light plant.

MURFREESBORO, ARK.—We are informed that bids will be called in about 90 days for the construction of the proposed hydro-electric power plant of the Pike County Water Power Company on the Little Missouri River, near Murfreesboro. The cost of the work is estimated at $600,000. The Fuller-Coult Company, of St. Louis, Mo., are consulting and supervising engineers.

ELSINORE, CAL.—The Consolidated Reservoir & Power Company, recently organized with a capital stock of $1,000,000, is preparing to construct large dykes across Elsinore Lake and propóses to utilize the water for irrigation purposes as well as for power purposes. The officers of the company are: Edwin Moore, of Los Angeles, president; R. B. Sheldon, of Riverside, vice-president, and W. B. Scarborough, secretary and treasurer.

MODESTO, CAL.—The transmission lines of the La Grange Light & Power Company, of La Grange, have been extended to this city.

MONROVIA, CAL.—The committee appointed to investigate the question of installing a new lighting system for Myrtle Avenue reports that the installation of a new system would cost about $1,300. Fred Goodsell is chairman of the committee.

STANWOOD, CAL.—The Pacific Gas & Electric Company is reported to have purchased the property of the Valley Power Company, and is said to be planning to install a large power plant on the property.

WILLOWS, CAL.—The Sacramento Valley Colony Company, which owns the Kraft ranch, is reported to have decided to erect a large power plant on its holdings, from which electricity will be transmitted to the different pumping plants which are to be established on the tract. It is said that this company is negotiating with the Sacramento Valley Land Company, which will permit the latter to connect its lines to those of the former at the intake of the canal, instead of building a line either to Hamilton or Orland.

CASTLE ROCK, COL.—The town of Castle Rock is contemplating the erection of a steam-driven electric light station, and may also install equipment for an ice manufacturing plant in connection with the electric plant.

CRIPPLE CREEK, COL.—Electrical power will be used in the work of extending the Blanchard tunnel on Copper Mountain. It is said that the transmission line recently extended to the Gold Issue Mine on Carbonate Hill will be further extended to Fluorine lode, where an electrically driven compressor will be installed.

HUGO, COL.—The Hugo Water, Light & Power Company has been granted a 20-year franchise to furnish the town with water and electricity for lamps. The cost of the combined plants is estimated at $70,000. The lighting and pumping plants will be combined.

JEWETT CITY, CONN.—Work will soon commence on the construction of the Hopeville dam for the Ashland Cotton Company. The dam will be located on the Pachaug River and will be 17 ft. high and 80 ft. long. An electric plant with an output of at least 400 hp. will be erected at the dam, and will furnish electricity for lighting the Hopeville mill and for operating the motors to be installed.

WILMINGTON, DEL.—The Wilmington City Electric Company has purchased a 1500-kw turbo-generator, one 500-kw motor-generator set, with exciter and new switchboard, of the Allis-Chalmers Company, of Milwaukee, Wis., for $75,000. The motor-generator set will be placed in the Fifth Street plant and the turbo-generator will be installed in the railway and light plant on the Brandywine River. The Fifth Street plant supplies the direct-current service.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 31, for furnishing at the navy yards and naval stations the following supplies: Mare Island, Cal., Schedule 1524, electrical supplies; 4000 cored and 4000 solid carbons. Mare Island, Cal., or Brooklyn, N. Y., Schedule 1527, 18,750 lb. rolled bronz, 7200 lb. brass tubing. Washington, D. C., Schedule 1535, insulating a room in basement of the naval medical school. Bids will also be received until Sept. 7 at the same place as follows: Mare Island, Cal., or Brooklyn, N. Y., Schedule 1548, 6000 lb. seamless drawn brass tubes. Applications for the proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 18 for installing two electric elevators at the Navy Yard, Mare Island, Cal. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. William M. Smith is acting chief of bureau.

SOUTH JACKSONVILLE, FLA.—The question of establishing an electric light plant, water and sewer systems is under consideration. Although the Legislature declined to authorize the Council to legalize a bond issue for municipal improvements, arrangements are being made for the granting of a franchise to private interests for the construction and operation of the system.

ATLANTA, GA.—The Railroad Commission has granted the Georgia Power Company permission to issue $1,550,000 in capital stock and $1,550,000 in bonds. The company has recently acquired the properties of the North Georgia Electric Company and the Etowah Power Company, and proposes to develop the water power on the Etowah River, near Canton, and the Chattahoochee River near Atlanta.

COLLEGE PARK, GA.—A committee has been appointed to make investigations pertaining to the installation of an electric light plant, water works and sewerage system. Charles A. Wickersham, J. C. W. Woodward, W. S. Cox, A. C. Brown and P. H. Brewster are members of the committee.

CHICAGO, ILL.—At the annual meeting of the Commonwealth Edison Company to be held Nov. 9 the stockholders will be asked to approve a recommendation made by the directors that the capital stock of the company be increased from $30,000,000 to $40,000,000. If the increase is authorized, $3,000,000 of the new capital stock will be issued to the stockholders at par, the proceeds to be used to cover the cost of improvements and extensions to the property.

OREGON, ILL.—The Oregon Power Company is carrying out extensive improvements. The town is situated on the Rock River. The flow at Oregon is sufficient for the ultimate development of 4000 to 5000 hp with a head of 10 ft. The company is now putting in the wheelpits for three 66-in. wheels and plans considerable changes in its generating equipment. The auxiliary steam plant will also be enlarged. G. W. Sturtevant, of Chicago, Ill., is consulting engineer in charge of the work, and in his absence on the coast Frank F. Fowle, of Chicago, has been in charge. The company is building transmission lines to supply various small towns in the vicinity of Oregon. Electricity will be transmitted at 13,000 volts, three-phase, 60 cycles.

BRAZIL, IND.—Both the Brazil Electric Company and the Terre Haute, Indianapolis & Eastern Traction Company submitted bids for furnishing electricity for lighting the city buildings, fire department and the viaduct in Brazil. Both bids were the same—6 cents per kw-hour. The Council rejected both bids.

INDIANAPOLIS, IND.—A permit has been granted to the Merchants' Heat & Light Company for the erection of a substation on Susquehanna Street.

KOKOMO, IND.—The County Commissioners have granted C. C. McFann, president and general manager of the Kokomo Western Traction Company, a franchise to construct a railway from Kokomo to Young America, which later will be extended to Burlington and Flora, a total distance of 15½ miles.

MARION, IND.—It is reported that the City Council is preparing to ask for bids for new equipment for the municipal electric light plant.

NEW ALBANY, IND.—Bids will be received by the Board of Public Works until Oct. 20 for lighting the streets, alleys and public places of the city by electricity for a term of 10 years from Sept. 1, 1910, according to specifications, which can be secured at the office of the board. John C. Short is city clerk.

SCOTTSBURG, IND.—The citizens have voted in favor of the proposition of giving a subsidy of $43,000 to the Cincinnati, Madison & Western Traction Company for the construction of its railway from Scottsburg to Madison. The line will ultimately extend to French Lick and Salem.

BOONE, IA.—At an election held Aug. 16 the citizens voted to grant

E. E. Hughes and associates a franchise to install an electric light and heating plant in Boone.

EOLIA, KY.—Arrangements are being made to build a local independent telephone line from Eolia, Ky., via Flat Gap, Va., Dewet, Guest's River and Lipps to Norton, Va., a distance of 30 miles. James P. Hartt and J. L. Hartt are interested in the project.

GUTHRIE, KY.—The Guthrie Light & Power Company is planning to install an electric plant in Guthrie, for the purpose of supplying electricity in Guthrie, Trenton, Pembroke, Elkton and Allensville. The company is in the market for second-hand 180 to 200-kw., three-phase, 60-cycle, 2200-volt, alternating-current generator, General Electric or Westinghouse make preferred. S. G. Ragsdale is interested in the company.

ALEXANDRIA, LA.—The citizens on Aug. 17 voted in favor of the proposition to issue $40,000 in bonds for improvements to the municipal electric light plant and water works system. Ira W. Sylvester is city engineer.

CLINTON, LA.—The question of issuing bonds for purchasing an electric light plant is under consideration.

BALTIMORE, MD.—The Architectural Commission has authorized Parker & Thomas, architects for the new power house to be erected at Bayview, to prepare plans for the building.

CONOWINGO, MD.—It is reported that the Susquehanna Electric Power Company is planning to begin work on the construction of its proposed hydro-electric plant on the Susquehanna River, for which surveys have already been made. The plans call for the construction of a dam and power plant and pole lines for the transmission of electricity to Baltimore and other cities. As yet no engineer has been engaged. The company is capitalized at $10,000,000. Joseph W. Marsh, president of the Underground Cable Company, of Pittsburgh, Pa., is president, and William H. Surratt, of Baltimore, Md., vice-president.

AMESBURY, MASS.—Extensive improvements are contemplated by the Hamilton Woolen Company, which will involve an expenditure of about $30,000. The work will include the construction of a new dam and the installation of new waterwheels, which will give the company 500 additional horsepower, making a total of 1500 hp. A power house will be erected at the large dam at Lake Gardner, where the water power will be utilized to generate electricity. It is estimated that 500 hp will be developed, giving the company 2000 hp in all. By using electricity the company will be able to abolish the engine and water wheels at No. 7 mill and close down the boilers and engines in mill No. 4, on Water Street, from eight to ten months in the year.

BELCHERTOWN, MASS.—At a special town meeting, held Aug. 17, the citizens voted to appropriate a sum not exceeding $600 to install an electric plant in the town.

BELLINGHAM, MASS.—At a special town meeting held recently a committeee was chosen to enter into a 10-year contract with the Edison Electric Illuminating Company for street lighting at the north end of the town, and with the Union Electric Light Company, of Franklin, to install 45 lamps in the South and Centre, for a term of three years. The lamps at the north end have been used for several years. The Selectmen, Hadley Perkins and Judson Camp are members of the committee.

GROTON, MASS.—The town has accepted the report of the special committee appointed to investigate the question of lighting the streets of the town by electricity. The committee recommended that the town install its own distributing system, at a cost of $15,000, and purchase electricity from the Ayer Electric Light Company. The street lighting system will include 155 tungsten lamps of 32 cp. in the town proper and 25 lamps in West Groton. The town will also furnish electricity to private consumers for lamps. The contract calls for 2300-volt, three-phase system, under which the town agrees to take 20,000 kw. a year at the rate of six cents per kw.-hour; the next 10,000 kw. at five cents per kw.-hour, and the second additional 10,000 kw. at four cents per kw.-hour. The commercial rate will be from 15 to 18 cents per kw.-hour. Henry K. Richards, Myron P. Swallow and Frank F. Waters are members of the committee.

SOUTHBRIDGE, MASS.—The Webster & Southbridge Gas & Electric Company will secure electricity from the Webster plant to operate the local system in the near future. The local power plant will be closed, but will be held in reserve for emergencies.

TURNERS FALLS, MASS.—The Franklin Electric Light Company is planning to establish an independent plant to supply electricity, and using the exhaust steam in public heating service. The company now secures electrical energy for operating its system from the Turners Falls company.

TOLUCA, MEX.—The Sultepec Electric Light & Power Company contemplates extending its 25,000-volt transmission line to Zacualpan, about 16 miles. R. J. M. Danley is vice-president and general manager.

MARQUETTE, MICH.—The City Council has granted the Cleveland-Cliffs Iron Company a franchise to construct and operate an electric transmission line within the city limits. The company is planning to extend its transmission lines from the Maas mine and from its power station on the Swanzey range. Two 1500-kw steam turbines will be installed. A new boiler will also be installed at the Maas mine power house.

DETROIT, MINN.—The citizens have voted to issue bonds for improvements to the municipal electric light and water works systems.

TYLER, MINN.—Bids will be received by P. D. Christensen, village recorder, until Aug. 27 for the construction of an electric light and water-works system, including the erection of a concrete building, gas-producer plant, pumping plant, dynamo, switchboard, pole line and wiring; also a 50,000-gal. concrete reservoir and 15,000-gal. air compressor tank. Oscar Claussen, of St. Paul, Minn., is engineer.

MACON, MISS.—Bids for remodeling the municipal electric light plant and water works will be opened Sept. 8. George U. Borde, of New Orleans, La., is consulting engineer.

PATTONSBURG, MO.—Plans have been completed for the construction of an electric light plant in Pattonsburg. It is proposed to erect transmission lines from Trenton to Pattonsburg, via Gallatin and Jamesport and establish a 24-hour service in Pattonsburg and intervening towns. Edgar B. Everly, manager of the Pattonsburg telephone exchange, is interested in the project.

ST. LOUIS, MO.—The plant of the Consumers' Light, Heat & Power Company has been put in operation and is now furnishing electricity in the Arcade Building. William H. Hauss is president of the company.

GLASGOW, MONT.—It is reported that plans are being considered for enlarging the electric light plant, which will include an addition to the power house for boiler room and pump pit; installation of boiler, two 500,000-gal. steam pumps, with necessary steam and water connections.

GREAT FALLS, MONT.—G. H. Gay, of Great Falls, has been granted a franchise by the Village Trustees to erect an electric plant in this village. It is said that Mr. Gay is planning to install a water-power plant, at a cost of $35,000.

LODGE POLE, NEB.—The question of establishing an electric light plant in Lodge Pole is under consideration.

MALMO, NEB.—At a special election held recently the citizens voted to issue bonds for the establishment of a lighting system.

VALLEY, NEB.—At a recent election the citizens voted in favor of the proposition to issue $17,000 in bonds to establish an electric light plant and water-works system in Valley.

HOBOKEN, N. J.—The Citizen's Light, Heat & Power Company has made a second application to the City Council for a franchise to erect an electric light plant in Hoboken. The company was granted a franchise by the Council last spring, which it did not accept.

IRVINGTON, N. J.—Proposals accompanied by plans and specifications for the installation of a municipal electric light plant will be received at the office of the town clerk until Sept. 7. For further information address George M. Williams, chairman.

ORANGE, N. J.—Plans prepared by Runyon & Carey, of Newark, N. J., consulting engineers, for the proposed municipal electric light plant have been approved by the Common Council. The cost of the plant, with wires placed underground on Main Street, is estimated at $76,000 and with wires overhead $65,000. The plans call for two 160-kw. generating units, switchboard, condenser, steam piping, etc. The street lighting system calls for nine arc lamp circuits, providing for 365 magnetite arc lamps and 65 tungsten street lamps. The equipment will be installed at the water works pumping station. Bids will be received until Sept. 20 for the above equipment.

PATERSON, N. J.—The residents of Totowa Borough and of West Park are considering the question of establishing an electric light plant to furnish electricity in this borough.

ALAMOGORDO, N. M.—The application of the White Mountain Power Company for water rights of the Ruidoso River and tributaries in Lincoln County sufficient to develop 5000 hp has been granted by the territorial engineer. The company proposes to utilize the power to generate electricity to be used for pumping purposes, electric lighting and other purposes at Fort Stanton, Carrizoza and other places. One of the conditions of the grant is that power is to be supplied to the settlers in the Ruidoso Valley at the same price that it is sold to other customers. The cost of the plant is estimated at $200,000, and the main canal is to be 10 miles long. Oliver M. Lee, C. E. Mitchell and J. L. Lawson, of Alamogordo, are interested in the enterprise.

PORTALES, N. M.—The United States Sugar & Land Company, of Garden City, Kan., is reported to have contracted with the farmers around Portales to furnish electricity for pumping water for irrigation. The company proposes to install a large power plant in Portales.

BROOKLYN, N. Y.—Harry P. Brearley, 12 Gates Avenue, Brooklyn, N. Y., is in the market for one 150-kw, 250-volt, direct-current belted generator; one 60-kw, 250-volt, direct-current belted generator; one 50-hp, 250-volt, direct-current motor; two 25-hp, 250-volt, direct-current motors; two 50-hp, two-phase, 220-volt motors; two 25-hp, two-phase, 220-volt motors; one 14-inch Corliss engine; two 100-hp, tubular boilers, and one 75-kw, direct connected, 220-volt unit.

LOWVILLE, N. Y.—Surveys are being made by the Wetmore Electric Company for an extension of its transmission line to Beaver Falls, Naumburg and Castorland. The main line will be tapped about one mile south of Croghan. The company will furnish electricity for house and street lighting and also for motors in all three villages. At Beaver Falls the company will supply electricity for the large plant of the James P. Lewis Company, which will utilize 500 hp. Electrical energy will be supplied to operate the two large grist mills, owned by Sidney Virkler, and several other small manufacturing plants in Castorland.

NEW YORK, N. Y.—The New York, Westchester, Manhattan & Boston Railway Company has applied to the Public Service Commission, Second District, for permission to an increase of $20,000,000 in its cap-

ital stock, which at present is capitalized at $4,000,000. The corporation, which is controlled by the New York, New Haven & Hartford Railroad Company interests, recently acquired the property and holdings of the New York & Port Chester Railroad, and asked for permission to consolidate the two properties, the same to be operated under the name of the New York, Westchester & Boston Company, which is constructing a four-track electric railway from the Lenox Avenue terminal of the subway to Port Chester, with a double track running from Mount Vernon to White Plains. It was stated at the hearing that the company will not build power plants of its own, but would secure electricity from the New York, New Haven & Hartford Railway Company.

NEW YORK, N. Y.—The Long Island Railroad Company has applied to the Public Service Commission, Second District, for permission to issue debentures to the amount of $16,500,000, the proceeds to be used to pay the Pennsylvania Railroad Company $6,032,951 loaned by that company and expended for various improvements during the years 1905 to 1908. The company states that it will require within the next three years additional capital for the construction work and for equipment necessary to continue the improvements which have been commenced, and on which large sums of money have been expended, which will include the main line improvement between Woodside and Jamaica, $2,000,000; Jamaica Terminal, $1,000,000; North Side improvements, double track electrification, $1,000,000; Bay Ridge improvement, elimination of grade crossings, $1,000,000.

HICKORY, N. C.—Surveys have been completed for the hydro-electric development near Hickory, being promoted by Col. T. J. Thornton, of Hickory, work on which will begin in September. Colonel Thornton also contemplates the organization of a company to erect a large cotton mill, to be operated by electricity, using 6000 hp.

CADIZ, OHIO.—Application has been made to the City Council by the Wheeling, Cadiz & Tuscarawas Traction Company for a franchise to construct an electric railway over certain streets in this city. A. E. Townsend, of Cadiz, is president and general manager.

GARRETTSVILLE, OHIO.—Plans are being considered for increasing the output of the local electric light plant, which will include the installation of a new engine and dynamo. Bruce, Fisher & Tuttle are owners of the plant.

COLUMBUS, OHIO.—Preparations are being made by the managers of the municipal electric light plant to establish a day service by Nov. 1. H. Gamper is superintendent.

LEBANON, OHIO.—Plans are being made by the Lebanon & Franklin Traction Company to extend its railway to Springboro, a distance of four miles. Robert E. Kline, Bank Building, Dayton, Ohio, is general manager.

McARTHUR, OHIO.—The City Council is reported to be considering the installation of a 60-hp gas engine direct connected to a 220-volt generator in the municipal electric light plant. A. E. Noble is superintendent.

MILLERSBURG, OHIO.—The question of establishing a day service is under consideration by the Millersburg Electric Light Company. Howard Richards is superintendent.

XENIA, OHIO.—It is understood that the plant and holdings of the People's Gas & Electric Light Company will be sold by the receivers in the near future. The Union Savings Bank & Trust Company, of Cincinnati, Ohio, is receiver.

RALSTON, OKLA.—T. E. Bryant, city clerk, writes that bids will be received about Sept. 1 for the construction of a municipal electric light plant and water works, for which an issue of $25,000 in bonds was recently voted. M. A. Earl & Company are engineers.

SUPPLY, OKLA.—Bids will be received by the State Board of Public Affairs until Sept. 14 for the complete installation of a heating and power plant at the Hospital for the Insane, at Supply, Okla., in accordance with plans and specifications prepared by Layton, Smith & Hawks, architects, of Oklahoma City, Okla., and to be erected under the supervision of the State Board of Public Works. Plans and specifications may be seen at the office of E. G. Newell, superintendent of hospital, Supply; at the office of the architect of State Board of Public Affairs, Guthrie, Okla., and at the office of Layton, Smith & Hawks, architects, Oklahoma City. Bidders to include in their proposals a two-ton ice-making plant to be installed in said building, plans and specifications for which to accompany the proposal, to be subject to the approval of the board and architects. Proposals to be addressed to Victor E. Harlow, secretary, Guthrie, Okla.

FOREST GROVE, ORE.—The United Railways Company has petitioned the City Council for a franchise to construct an extension of its system into Forest Grove.

PENDLETON, ORE.—The Umatilla Railway & Electric Power Company is planning to construct an electric railway from Pendleton to Dale, a distance of about 100 miles, and also proposes to erect a hydro-electric plant on the John Day River. The company is capitalized at $100,000, and the officers are: Douglas Belts, of Pilot Rock, president; George A. Brown, vice-president and general manager, and A. R. Turner, secretary and treasurer.

PORTLAND, ORE.—Plans are being considered by the Rose City Park Improvement Association for lighting and paving the Sandy Road, known as the Rose City Avenue. It is proposed to install lamps from Twenty-eighth Street to the city limits at once.

UNION, ORE.—A special election will soon be called to vote on the proposition to issue bonds for the construction of a municipal electric plant.

ERIE, PA.—The Erie Electric Company, it is reported, is planning to construct a large electric power plant on the bluff of the harbor, just west of the Pittsburgh docks. The cost of the plant is estimated at about $200,000. The three-phase system will be installed. When the new station is completed the present power house will be used as a distributing station.

PHILADELPHIA, PA.—The Philadelphia Electric Company has awarded the contract for the construction of its new power house on Kensington Avenue, north of J Street, to John R. Wiggins & Company, for $18,000.

SPARTANSBURG, S. C.—The Electric Power & Manufacturing Company, which has a large hydro-electric plant at Gaston Shoals, S. C., is reported to be negotiating for the purchase and development of another water power site in the same section. This company owns and operates the Spartansburg Railway, Gas & Electric Company, and is said to be interested in the development of an extensive interurban railway system in the northern section of this State.

INKSTER, S. D.—The citizens are considering the question of installing an electric light plant.

IPSWICH, S. D.—It is reported that work will soon commence on the construction of an electric light plant in Ipswich, for which $10,000 has already been subscribed by the citizens.

RAPID CITY, S. D.—The Dakota Power Company, it is said, has consolidated the Richards, Duncan and Mansfield water rights, thus securing a fall of 1009 ft., capable of developing 8000 hp. The company proposes to build a power plant at a cost of about $1,500,000.

BROWNSVILLE, TENN.—The Brownsville Cotton Oil & Ice Company has purchased the plant and holdings of the Brownsville Light & Power Company. It is said that the new owners will remodel the plant and install new machinery. Robert N. Bond will be general manager.

LEBANON, TENN.—H. B. Bond, of Lebanon, has been granted a 99-year franchise to construct and operate a street railway in Lebanon.

PADUCAH, TEX.—The citizens are considering the question of installing an electric light plant. W. H. Winton, secretary of the Commercial Club, would like to correspond with parties interested.

BRIGHAM CITY, UTAH.—Arrangements have been completed by Messrs. Bell, Ray and Baker, of the Ogden Portland Cement Company for the transmission of electricity from the power plant of the Utah Smelter, at Hot Springs, to their cement factory at Brigham City.

LOGAN, UTAH.—Application has been made to the City Council by David Eccles, president of the Ogden Rapid Transit Company, of Ogden, Utah, for a franchise to construct a street railway system in Logan. The proposed extension which is to extend from Ogden to Logan, via the Cache Valley, a distance of sixty miles, has already been built as far as the Ogden Valley, a distance of fifteen miles.

BARTON, VT.—Arrangements are being made by the Village Trustees to begin work on the installation of a new penstock at the Barton electric plant at Charleston. Electricity for operating the local system will be furnished by the Island Pond Electric Company, while the municipal electric plant is shut down for repairs, which it is expected will take about two weeks.

MARTINSVILLE, VA.—Plans are being considered for enlarging the dam and increasing the output of the municipal electric light plant.

SEATTLE, WASH.—The City Council has passed the ordinance providing for the installation of cluster lamps on Eleventh, Twelfth, Thirteenth, Fourteenth, Fifteenth, Sixteenth and Eighteenth avenues.

WHEELING, W. VA.—The City & Elm Grove Railroad Company has made application to the County Commissioners for a franchise to extend its electric railway around Wheeling Park and at Park View.

DE PERE, WIS.—The De Pere Electric Company is preparing to change its system from direct to alternating current, at a cost estimated at $10,000.

NEW RICHMOND, WIS.—Preparations are being made by the Wisconsin Telephone Company for rebuilding its entire plant in this city. Aerial wire will be replaced by cables throughout.

SOMERSET, WIS.—Negotiations have been completed by the Apple River Power Company, a subsidiary of the Washington County Light & Power Company, of Stillwater, Minn., for the purchase of the Ames-Mason mill property, just below Somerset. The new owners propose to erect a dam with a 41-ft. head and install another electric power plant. It is estimated that about 2000 hp will be developed, which will be transmitted to Stillwater and the Twin Cities. When completed it will make the fifth plant operated by the company.

LADYSMITH, B. C., CAN.—The city has awarded the contract to the Canadian Westinghouse Company for a complete power plant. G. M. Turney is city electrical engineer.

NELSON, B. C., CAN.—The officials of the Canadian Pacific Railroad Company, it is reported, are contemplating equipping the Columbia & Western branch to be operated by electricity. It is said that 35,000 hp is available at Bonnington Falls; there are also several other good water powers along the line, not yet developed. For further information address Lorne A. Campbell, Nelson, B. C.

NEW WESTMINSTER, B. C., CAN.—The international Electric Railway Company will soon commence the construction of its proposed electric railway from a point in the Municipality of Surrey to a point at or near

Port Kells. Bowser, Reid & Wallbridge, of Vancouver, B. C., are attorneys for the company.

WINNIPEG, MAN., CAN.—Preparations are being made to erect the transmission lines for the distribution of electricity from the municipal electric plant now under construction.

WINNIPEG, MAN., CAN.—The Winnipeg Electric Railway Company is planning to construct a nine-track car barn to be erected in the north end of the city at a cost of $100,000, which includes the cost of the construction of a repair shop and substation.

COBALT, ONT.. CAN.—Orders have been placed by the Mines Power Company for four 5000-cu. ft. air compressors, giving it a total capacity of 20,000 cu. ft. Each of the compressors will be operated by a 1000-hp, alternating-current motor, electricity for which will be obtained from the company's electric power plant located at the Matabitchuan in South Lorain. The new machinery will be installed in the two substations at Kerr Lake and Cobalt, which will supply the upper and lower ends of the Cobalt camp with electricity and air. The two stations will be connected, so that they can be thrown into one system.

FORT FRANCIS, ONT., CAN.—The Rainy River Radial Railroad Company is seeking a charter to build several electric car lines between Fort Francis, Ont., and the American boundary near International Falls.

HARTLAND, ONT., CAN.—John E. Stewart and A. E. Downworth are reported to be interested in a project to construct an electric railway to connect Hartland, Foreston, Rockland, Windsor and Knowlesville.

PORT HOPE, ONT., CAN.—Arrangements are being made by the Durham-Northumberland Power Company for the development of extensive water power rights in the vicinity of Port Hope. Ont. J. A. Culverwell is managing director.

TORONTO, ONT., CAN.—John Hagmen & Company, of London, Ont., have been awarded the contract for the construction of the interswitching station, and also for the step-up transformer station in connection with the hydro-electric development. The prices are, respectively, $35,000 and $47,700.

TORONTO, ONT., CAN.—Bids will be received by the city of Toronto until Oct. 14 for electric motors as follows: Four 1500-hp. synchronous motors; two 1500-hp. induction motors; four 500-hp. synchronous motors; four 500 hp. induction motors and two 225-hp. synchronous motors, with exciters, switchboards, connecting material, etc. For specifications and form of tender apply to the city enginer. Bids will also be received by the city on the same date for the following turbine pumps: Four 13,500,000-gal. pumps, 100 lb. pressure; two 5,000,000-gal. pumps, 300 lb. pressure; two 10,000,000-gal. pumps, 65 lb. pressure; two 10,000,000-gal. pumps, 110 lb. pressure; two 6,500,000-gal. pumps, 90 lb. pressure; two 6,500,000-gal. pumps, 160 lb. pressure; two 1,500,000-gal. pumps, 65 lb. pressure; two 1,500,000-gal. pumps, 110 lb. pressure, with valves, piping, bed plates, couplings, etc. For specifications and form of tender apply to the city engineer.

MONTREAL, QUE., CAN.—The Montreal Light, Heat & Power Company is contemplating the installation of an ice plant, to cost from $125,000 to $150,000.

REGINA, SASK., CAN.—Plans have been completed for the construction of an electric street railway system in Regina, which are now under consideration by the City Council. For further information address Alderman Peverett.

New Industrial Companies.

THE ACKER-NIGHTINGALE CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated by Craig E. Nightingale, of Rye, N. Y.; B. S. Acker, of Cresskill, N. J., and George A. Acker, of Haworth, N. J. The company is capitalized at $2,500 and proposes to do designing, construction, engineering, architecture, etc.

THE AUTOMATIC FALSE ALARM DETECTIVE COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $100,000, by J. B. Nicholson, D. B. Miller, Jr., F. C. Geiger, of Washington, D. C.

THE DEXTER-CHAPMAN ENGINEERING COMPANY, of Arlington, N. J., has been incorporated with a capital stock of $25,000, by E. Norton, A. H. Jackson and J. L. McCord, of Arlington, N. J. The company proposes to do a general engineering and contracting business.

THE HULIT TRANSMITTER COMPANY, of Topeka, Kan., has been chartered, with a capital stock of $50,000, for the purpose of manufacturing and dealing in telegraph transmitters, keys, equipment and apparatus. The directors are: E. C. Arnold, O. C. Neiswander, C. E. Curry, E. A. Clarke and J. A. Rosser.

THE INTERNATIONAL COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $50,000, by E. G. Reed, R. L. Reed, of Wilkinsburg, Pa., and C. R. Buckhelt, of Pittsburgh, Pa.

THE INVINCIBLE CLEANING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000, to manufacture renovators and cleaning machines, by M. E. Poffingbarger, W. H. Duval and A. E. Lake.

THE WIEBE ENGINEERING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $100,000, by W. C. Gilmore, C. F. Hathaway and F. K. Jones, of New York, N. Y. The company proposes to do a general engineering construction business, etc.

THE WUNDERBUTTON LIGHT COMPANY, of New York, N. Y., has been chartered by W. V. Ebert, W. G. Smith and P. J. Smith, of New York, N. Y. The company is capitalized at $100,000 and proposes to manufacture lamps, machinery and appliances for the production of light and heat.

New Incorporations.

BIRMINGHAM, ALA.—The Birmingham Water, Light & Power Company has been incorporated, with a capital stock of $20,000, by Charles E. Glover, of North Birmingham and others.

BIRMINGHAM, ALA.—The National Mining & Power Company has been organized, with a capital stock of $2,500,000, and proposes furnishing power throughout the mining section in the State of Alabama. The officers of the company are: C. F. Wheelock, of Birmingham, president; W. K. Wheelock, vice-president, and M. H. Bone, secretary and treasurer.

SAN FRANCISCO, CAL.—The Railroads & Power Development Company has been incorporated under the laws of Maine. The company is to be a holding company for the Stanislaus Power Development Company and the San Francisco Electric Railways Company, and will also hold $10,000,000 of the $18,000,000 of the common stock of the United Railroads of San Francisco.

CARTERVILLE, ILL.—The Interurban Electric Company has been incorporated by F. W. Richart, E. E. Denison and H. B. Cassel. The company is capitalized at $150,000, and proposes to operate an electric light, heat and power plant.

ELDORA, IA.—The Iowa Light & Traction Company has been incorporated under the laws of South Dakota with a capital stock of $500,000, for the purpose of constructing an electric railway from Boone to Ogden, Ia., with branches to Ames, Story City, Eldora, Des Moines, Webster City and Perry, Ia. The officers of the company are: Henry S. Osborne, chairman of board; Andrew Stevenson, of Chicago, Ill., president and general manager; E. Hughes, of Boone, Ia., vice-president and treasurer, and J. F. Hardin, of Eldora, secretary. The headquarters of the company are at 153 LaSalle Street, Chicago, Ill.

AURORA, MO.—Articles of incorporation have been filed for the Lawrence County Light, Heat & Storage Company, with a capital stock of $250,000, by J. E. Woodhill, E. Emmett Brown and C. M. Kirby.

ST. LOUIS, MO.—The St. Louis & Kansas City Electric Railway Company has been organized to construct a double-track, high-speed, polyphase, electric railway from St. Louis to Kansas City, a distance of 250 miles. The company will be capitalized at $15,000,000. W. D. Nevi, of Denver, Col.; W. H. Chase, B. F. Gray, Edgar R. Talton, of St. Louis, Mo., and Daniel F. Miller are interested in the enterprise.

NINNEKAH, OKLA.—The Ninnekah Electric Light & Power Company has been incorporated, with a capital stock of $21,000, by R. M. Evans, of Chickasha, Okla.; R. J. Gordon and C. M. Lentz, of Ninnekah.

OKLAHOMA CITY, OKLA.—The Oklahoma City & Suburban Railway Company has been chartered with a capital stock of $250,000 for the purpose of constructing four interurban railways, the main route to extend from Britton to Edmond and Oklahoma City to Moore, 32 miles in length. The incorporators are: Charles W. Ford, superintendent of the Oklahoma Railway; J. J. Johnson, Fred S. Combs, W. A. Haller and Richard Durret, all of Oklahoma City.

PORTLAND, ORE.—Articles of incorporation have been filed for the McKenzie Power Company, with a capital stock of $25,000, by A. Welch, I. Andeson and E. W. Hall.

PORT ARTHUR, TEX.—The Port Arthur Traction Company has been chartered, with a capital stock of $200,000, to construct an electric railway in Port Arthur six miles in length. The incorporators are: H. J. Myers, A. H. Reeder, of Dayton, Ohio, and A. L. Davis, of Harris County. The headquarters of the company are at 503 Reibold Building, Dayton, Ohio.

NORTH YAKIMA, WASH.—The Yakima Central Heating Company has been incorporated, with a capital stock of $100,000, to do a central-station heating business. It is proposed to erect a plant having 800-hp boiler capacity, with feed-water heaters, boiler feed pumps, etc. The Schoof Engineering Company, of Chicago, Ill., has the contract for the installation of the plant, the cost of which is estimated at $100,000.

GREAT CACAPON, W. VA.—Articles of incorporation have been filed for the Hydro-Electric Development Company by William B. Osler, Morris A. Ornduff, of Great Cacapon; William F. Disher, of Berkeley Springs, W. Va.; Samuel R. Boyer, of Hanover, Pa.; and Albert Holland, of Baltimore, Md. The company is capitalized at $100,000, and proposes to develop the water power of the rapids in the Great Cacapon River to be utilized to generate electricity, which will be transmitted to towns in Hampshire and Morgan counties.

OTTAWA, ONT., CAN.—The Dominion Electric Company has been incorporated here, with a capital stock of $40,000, by T. A. Low, R. Hadley and W. T. Guest.

Legal.

COURT HOLDS UP LIGHTING CONTRACT.—Judge Stevens of the County Court on Aug. 9 granted a temporary injunction against the execution of the contract recently awarded to the Metropolitan Electric Company by the City Council of Reading, Pa., for a period of 10 years. At the final hearing, which will take place in two weeks, the city will be enjoined from awarding a contract for a longer period than five years.

Personal.

MR. R. S. WALLACE has been appointed general manager of the Peoria Gas & Electric Company, of Peoria, Ill. For several years Mr. Wallace has been superintendent of the company.

MR. HARRY B. KIRCHER has resigned as local manager of the Belleville Gas & Electric Company, a position he has held for five years. Mr. Kircher is undecided as to what work he will take up in the future.

MR. W. L. WATERS, engineer in charge of turbo-generator work of the Westinghouse Electric Mfg. Co., sailed for Europe August 25 on a short business trip. Mr. Waters expects to be away about a month.

MR. HAROLD S. SCHUTT, manager of the Michigan City Gas & Electric Company, of Michigan City, Ind., has been appointed general manager of the Wilmington Gas & Electric Light Company, of Wilmington, Del.

MR. H. E. M. KENSIT, of Messrs. Smith, Kerry & Chace, consulting engineers, Toronto, has left Toronto and will in future reside in Calgary, Alta., where that firm has opened an office at 68 McDougall Block.

MR. HUGO REISINGER was received by the Emperor and Empress of Germany on Aug. 21 during a visit of their majesties to the Saalburg Museum, to which Mr. Reisinger had presented a valuable collection of Roman antiquities.

MR. WILLIAM N. PATTEN, engineering manager of the Stone & Webster Engineering Corporation, has become associated with the construction department of the company, and Mr. Frederic N. Bushnell has succeeded him as engineering manager.

PROF. L. P. DICKINSON, for the past six years assistant professor of electrical engineering in Lafayette College, has resigned from that institution to accept the chair of physics and electrical engineering in Rhode Island State College, Kingston, R. I.

MR. E. D. RASMUSSEN has resigned from the Choctaw Railway & Lighting Company, McAlester, Okla., to join the Allis-Chalmers Company. Mr. Rasmussen was formerly electrical engineer and superintendent of the power plant of the El Paso Southwestern System.

MR. F. C. ARMSTEAD, supervising engineer of the stoker department of the Westinghouse Machine Company, who, for a number of years, has been located at East Pittsburgh, Pa., has moved his headquarters to the Westinghouse works, Attica, N. Y., where the stokers are manufactured.

MR. PAUL H. SMITH, formerly district engineer for the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., in charge of the erecting department in St. Louis, Mo., has been appointed superintendent of the Pittsburgh & Butler Street Railway Company, of Pittsburgh, Pa., succeeding Mr. W. M. Kessler, resigned.

PROF. ALBERT A. MICHELSON, professor of physics at the University of Chicago, received the honorary degrees of doctor of philosophy and master of liberal arts from the University of Leipsic on the occasion of the five-hundredth anniversary of that institution. Professor Michelson's work in optics gained him the Nobel prize of $40,000 in 1907.

MR. HOWARD P. LINGO, formerly with the Foster & Glidden Engineering Company, of Buffalo, N. Y., has accepted a position with the Northern Idaho & Montana Power Company, and will be located at Kalispell, Mont. Mr. Lingo was for a number of years connected with the construction department of the Westinghouse Electric & Manufacturing Company.

MR. ARTHUR ROSCOE DENNINGTON, who was formerly in charge of the electrical engineering laboratories at the Pennsylvania State College, and who for the past two years has been assistant principal of the electrical department of the International Correspondence Schools, will spend a year in England assisting in the development of technical correspondence courses for the London branch of the International Educational Publishing Company.

PROFESSOR MILLARD C. ERNSBERGER has been appointed Dean of the new department of Applied Science at the University of Rochester. Professor Ernsberger graduated from the University of Rochester in 1888, and took up the practice of law. Finding this uncongenial, he entered the industrial field, and after rising to be general superintendent of a large works, resigned to enter Cornell University to take its course in mechanical and electrical engineering, and upon graduation remained as instructor in Sibley College.

MR. FREDERIC N. BUSHNELL, who has just been appointed engineering manager of the Stone & Webster Engineering Corporation, joined the staff of Stone & Webster in February, 1907, taking charge of the construction of the Lincoln, Harvard and Charlestown power stations of the Boston Elevated Railway. This work consisted in substantially enlarging the structures of the three original stations and installing 20,000 hp of new generating capacity with boilers and all other auxiliaries. It was carried out in the exceptionally short period of 10 months. Previously, Mr. Bushnell was chief engineer of the Rhode Island Company, in charge of design and construction of power stations, substations, car barns, bridges, tracks, and also of operation of power stations. In connection with a large station designed and built under his supervision at Providence, there was conducted a service test which lasted an entire year and established a record for economical operation that has rarely been equaled. Mr. Bushnell is regarded as an authority on the design and operation of power stations.

Obituary.

GEORGE T. HEDRICH, for the past 18 years in the electrical engineering department of the Westinghouse Electric & Manufacturing Company, died on Aug. 9 at Pittsburgh after a short illness, at the age of 49 years. He is survived by a widow.

MR. CHARLES S. KNIGHT, for many years prominently identified with the electrical business throughout the country, died at his home at Fort Wayne, Ind., Aug. 14, from Bright's disease and other complications. In the early eighties Mr. Knight was manager of the Fort Wayne Gas Company. In 1885 he became associated with the late R. T. McDonald in the old Fort Wayne Electric Company, and was vice-president and sales manager of that company until 1898, when he removed to Chicago to become general manager of the Siemens & Halske Electric Company. After this company was sold to the General Electric Company, Mr. Knight returned to Fort Wayne and for the past several years devoted his time to his mining interests.

Trade Publications.

ASBESTOS.—A mailing folder being distributed by the H. W. Johns-Manville Company, 100 William Street, New York, briefly describes, illustrates and lists the various materials in which use is made of asbestos.

CONTROLLERS.—The Electric Controller & Manufacturing Company, Cleveland, Ohio, has issued in booklet form a series of five articles dealing with electric-motor control, written by its president, Mr. A. C. Eastman. The articles are of a more or less technical nature, but are written in a style to be readily understood by any one familiar with machinery.

TRANSMISSION LINE SPECIALTIES.—A loose-leaf catalog issued by the Monroe Electrical Manufacturing Company, Monroe, Mich., contains descriptions and price lists of cable-hangers, duct-rods, cable-arms, plug-boxes, pole-seats, time-switches, turnbuckles, pay-out reels, distribution racks, guy anchors and other devices used in the erection of transmission and distribution circuits.

WAKEFIELD FIXTURES.—The F. W. Wakefield Brass Company, Vermilion, Ohio, has issued a folder explaining and illustrationg the "Wakefield idea" in electrical fixtures. With a relatively few Wakefield parts in stock a practically unlimited number of styles of fixtures can be quickly assembled. Moreover, the detail parts are of such a design that the fixtures in which they enter can be given an artistic appearance far superior to that of the staple low-priced fixture.

Business Notes.

THE CROCKER-WHEELER COMPANY will open an office in the Ford Building, Detroit, Mich., on Sept. 10. Mr. Charles W. Cross will be the manager of the new branch.

THE SCHOTT ENGINEERING COMPANY, of Chicago, Ill., has moved its office from 125 Monroe Street to 315 Dearborn Street. At the new location, on the ninth floor of the Manhattan Building, the company is fitting up a handsome suite of offices.

THE GARWOOD ELECTRIC COMPANY announces that it has appointed the Charlotte Contract Company, Charlotte, N. C., as sales agent for North Carolina and South Carolina. The Charlotte Contract Company is a well-known concern, making a specialty of cotton machinery and steam-heating apparatus.

THE HOYT ELECTRICAL INSTRUMENT WORKS announce that Mr. E. W. Carter, who has for some time past been in charge of the Boston office, will hereafter be connected with the factory, and Mr. A. K. Brown will succeed him in charge of the Boston office. Mr. Brown has been identified with Hoyt instruments for a considerable time, and is therefore well equipped for his new position.

THE CRESCENT COMPANY, 106 South Clinton Street, Chicago, Ill., announces that it has recently taken the agency for the American Conduit Manufacturing Company, of Pittsburgh, Pa., maker of American rigid iron conduit and "Wireduct" non-metallic flexible conduit. It has also taken the agency for the Lowell Insulated Wire Company, of Lowell, Mass., maker of lamp cords, telephone wire and all kinds of rubber insulated wire. The Crescent Company carries a complete Chicago stock of all that is standard in each of these lines so as to insure prompt shipment of rush orders.

DALLAS WESTERN ELECTRIC BUILDING.—The Dallas business of the Western Electric Company was recently moved into its new quarters in its own building, at Pacific and Evay streets, a three-story and full-basement model structure. The Western Electric Company has been in Dallas two years, but during this time business has increased to such an extent that the old quarters were found inadequate, and as a result this new structure, costing approximately $100,000, has been built. The building, which serves as a storehouse, and contains the offices of the company, also includes a large repair shop, to take care of the ordinary repairs of the apparatus handled by the company. Employment will be given to about 125 men, which is an increase of 50 per cent over those formerly employed by the company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS, ISSUED AUG. 17, 1909.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

931,033. LIGHTNING ARRESTER; W. E. Butler, David City, Neb. App. filed July 16, 1908. Lightning arrester of the mercury type in which the terminals enter a bath of mercury contained in the vessel.

931,034. X-RAY APPARATUS; E. W. Caldwell, New York, N. Y. App. filed March 5, 1906. Combined closed cabinet and impervious shield with the indicating and control devices arranged near a window through which the protected operator looks.

931,055. AUTOMATIC TELEGRAPH AND SELECTIVE SYSTEM THEREFOR; A. C. Gilmore, Chicago, Ill. App. filed Oct. 6, 1904. Selectively controls a printing machine by means of a relay controlled by the line impulses which mechanically operate a set of selectors controlling the type wheel.

931,068. GALVANIC SOLE; F. Kennedy and J. V. Davis, Bournemouth, Eng. App. filed Aug. 8, 1908. Details.

931,072. AUTOMATIC TELEPHONE EXCHANGE SELECTOR; F. H. Loveridge, Chicago, Ill. App. filed Aug. 2, 1906. The selector has a number of rows of line terminals arranged in a field with a contact arm, which rotates to select one of the rows and moves longitudinally to the desired terminal in the selected row.

931,081. PROCESS OF PREPARING STORAGE BATTERY ELEMENTS; D. P. Perry, Chicago, Ill. App. filed Dec. 26, 1903. Dissolves and cadmium precipitates the hydrates converts to their oxides and secures the oxides to a support.

931,082. PROCESS OF PREPARING ALKALINE ELECTROLYTES FOR STORAGE BATTERIES; D. P. Perry, Chicago, Ill. App. filed Dec. 26, 1903. Prepares an alkaline zincate by placing it within a battery, charging the battery, pouring off the solution and washing out the battery and replacing with a purified alkaline solution.

931,092. ELECTROLYTIC PRODUCTION OF MAGNESIUM; G. O. Seward and Franz von Kugelgen, Holcombs Rock, Va. App. filed March 28, 1906. Fuses magnesium chlorid, to which is added a denser alkaline earth chlorid.

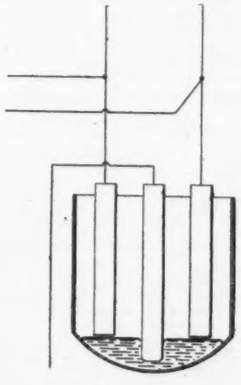
931,105. COMMUTATOR FOR DYNAMO ELECTRIC MACHINES; J. E. Webster, Pittsburgh, Pa. App. filed Sept. 8, 1908. For direct-current turbine-driven generators, in which the commutator includes a series of disks with wedge-shaped blocks electrically connected.

931,114. SYSTEM FOR VAPOR ELECTRIC APPARATUS; F. Conrad, Swissvale, Pa. App. filed Jan. 10, 1908. For mercury vapor lamps upon alternating circuits, in which a current rectifier is used and a transformer interposed between the circuit and the rectifier, having means for introducing inductance into the circuit supplied therefrom.

931,115. SYSTEM OF DISTRIBUTION FOR MERCURY VAPOR RECTIFIERS; F. Conrad, Swissvale, Pa. App. filed Dec. 6, 1907. Includes a transformer with two series connected secondaries and two series connected primaries movable with respect to the secondaries, together with a core having a leakage path and a rectifying device.

931,116. DYNAMO-ELECTRIC MACHINE; J. D. Forrer, Pittsburgh, Pa. App. filed Oct. 7, 1908. Improvement in commutators which are protected from excess lubricating fluids by flanges which carry off the fluid by centrifugal force.

931,123. DEVICE FOR HOLDING FIRE ALARM KEYS; A. Iske, Lancaster, Pa. App. filed June 23, 1908. Prevents the key from being taken surreptitiously by providing a wheel with a key holding compartment registering with an opening so that the key cannot be withdrawn until the wheel is turned to register with the opening.



931,033.—Lightning Arrester.

931,133.—Arc Lamp Electrode.

931,124. CURRENT RECTIFYING APPARATUS; R. P. Jackson, Wilkinsburg, Pa. App. filed March 9, 1908. A transformer having a magnetizable core with two legs, a plurality of coils surrounding each leg, the intermediate ones being subdivided and leakage paths of low reluctance between the coils.

931,126. CONTROL SWITCH AND SYSTEM; H. D. James, Pittsburgh, Pa. App. filed Dec. 14, 1908. The switch contacts have an operating coil, a blow-out coil, a spring restrained armature for the blow-out coil and means for holding it in position when the main switch is closed.

931,127. TELEPHONE TRANSMITTER; A. G. Kaufman, New York, N. Y. App. filed Aug. 28, 1907. Regulates the instrument to varying heights by cord and pulley attached to the transmitter.

931,130. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; B. G. Lamme, Pittsburgh, Pa. App. filed Oct. 7, 1908. For cooling commutators by providing ventilating ducts, the commutator segments being of unequal depth to form the ducts.

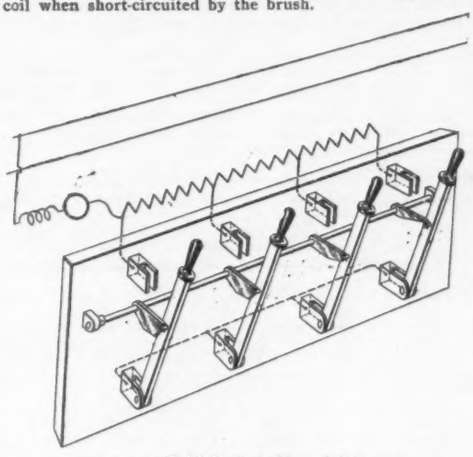
931,133. ARC-LAMP ELECTRODE; G. M. Little, Pittsburgh, Pa. App. filed Sept. 3, 1907. A flaming arc lamp, in which the electrode contains an alloy of iron and chronium in a granulated condition.

931,136. VARIABLE SPEED ALTERNATING-CURRENT MOTOR; R. D. Mershon, New York, N. Y. App. filed May 28, 1906. A rheostat controls the secondary by means of a motor.

931,138. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM; J. L. McQuarrie, Oak Park, Ill. App. filed Nov. 23, 1907. For answering a call on a trunk line at any one of several stations, the answering telephone being also utilized for communicating with another local station without disconnecting the signal at central.

931,148. MULTIPLE-SWITCH RHEOSTAT; O. S. Schairer, Pittsburgh, Pa. App. filed Nov. 8, 1908. Provides a series of independently actuated switches with a plurality of inter-connected dogs mounted for rotative movement to prevent each switch, except the first of the series, from closing unless the next preceding switch is closed.

931,150. WINDING OF ARMATURES FOR ALTERNATING-CURRENT MOTORS; B. C. Shipman, Baltimore, Md. App. filed Jan. 29, 1906. Single-phase commutator motor generates in the leads between the coil and the bars an e.m.f. equal and opposite to that in the coil when short-circuited by the brush.



931,148.—Multiple Switchboard Rheostat.

931,156. WINDING FOR DYNAMO ELECTRIC MACHINES; H. C. Specht, Wilkinsburg, Pa. App. filed July 26, 1906. For a synchronous motor windings in which a plurality of groups of coils are used, each group producing a pair of adjacent unlike poles and successive groups in the circuit being arranged in a different order as to position in the winding.

931,157. ELECTRIC SELF-WINDING CLOCK; J. Steiger and J. Besancon, La Chaux-de-Fonds, Switzerland. App. filed Feb. 11, 1907. The driving weight is suspended by a cord wrapped around a drum released by a pawl and ratchet and driven by the motor.

931,165. FLEXIBLE CONNECTION FOR CO-OPERATING MEMBERS; J. E. Webster, Pittsburgh, Pa. App. filed Dec. 3, 1906. For connection between a motor and the part driven thereby, the connection including a chamber with a co-operating member and resilient means surrounding the member within the chamber.

931,168. ARC LAMP; S. P. Wilbur, Wilkinsburg, Pa. App. filed April 28, 1906. Cut-out and feed regulator for arc lamps, including an E-shaped core with an auxiliary projecting portion and suitable windings mounted on the projections.

931,169. ELECTRODE FOR ARC LAMPS; S. P. Wilbur, Wilkinsburg, Pa. App. filed April 28, 1906. Flaming-arc lamp having a tubular electrode with lateral apertures surrounded by a hood.

931,179. TELEPHONE DESK STAND; J. A. Birsfield, Chicago, Ill. App. filed Oct. 24, 1906. Hinged joint for the transmitter of neat construction having a positive hinge and ample clearance for the wires. Also details in the hook switch mechanism.

931,205. CONTROL SYSTEM AND SWITCH; H. D. James, Pittsburgh, Pa. App. filed Dec. 14, 1908. For controlling electric motor by means of a plurality of solenoid operated switches with blow-out magnets.

931,231. MOUNTING FOR TELEPHONE INSTRUMENTS; H. E. Shreeve, Wyoming, N. J. App. filed Aug. 21, 1908. Watch-case type of receiver mounted on a handle. Details.

931,242. AUTOMATIC POLE CHANGER; F. H. Williams and C. W. Welch, Greene, N. Y. App. filed March 8, 1907. Switchboard of telephone exchange in which the signaling apparatus is controlled by the operator's key for ringing the magneto bells. The improvement relates to the pole changer for the signaling circuit.

931,264. CIRCUIT BREAKER; R. L. Browne and A. R. Howell, New York, N. Y. App. filed May 11, 1906. The circuit breaker includes a liquid column conducting the current, a trough therefor, an insulator thereon, with means for volatilizing the liquid and for collecting the volatilized liquid and returning it.

931,292. TROLLEY AND SUPPORT THEREFOR; S. S. Goldman, St. Louis, Mo. App. filed Sept. 14, 1908. For preventing the trolley from leaving the wire by providing the wheel on opposite sides with a pair of carrier arms carrying guard wheels.

931,301. TROLLEY WIRE HANGER; R. B. Heimbecker, Wilkinsburg, Pa., and S. R. M. Orum, Philadelphia, Pa. App. filed Feb. 24, 1908. A clamp for use with grooved trolley conductors, consisting of a sheet-metal gripping member of triangular shape with hook-shaped projections at the lower end, a wedge, a hanger rod and nut.

931,302. INDUCTION MOTOR; R. E. Hellmund, Pittsburgh, Pa. App. filed Dec. 4, 1907. An induction motor of the squirrel-cage type in which certain conductors are connected in multiple, and others separated by a distance different from the pole pitch are connected with means for establishing and interrupting the connections.

931,307. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM; N. H. Holland, Chicago, Ill. App. filed Nov. 23, 1907. For answering a call over a trunk line at any of several stations whereby the telephone used for answering may also communicate with a local station without disconnecting the signal at central.

931,330. TELEPHONE EXCHANGE SWITCHBOARD APPARATUS; J. L. McQuarrie, Oak Park, Ill. App. filed March 8, 1906. A one-wire circuit for central switchboards. Details.

931,331. TELEPHONE KEY; J. L. McQuarrie, Oak Park, Ill. App. filed Nov. 23, 1907. A plurality of plunger keys each when depressed being locked to close individual contacts, and when further depressed closing a pair of contacts common to all the keys.

931,336. PROCESS AND APPARATUS FOR PRODUCING DIRECT CURRENTS HAVING LIMITED STRENGTH; M. M. Osnos, Frankfort-on-the-Main, Germany. App. filed Oct. 29, 1907. Sets up a subsidiary magnetic field to the armature dependent upon the strength of the working current, which weakens the main field on increase of the working current.

931,345. TROLLEY CLAMP; E. E. Rose, Pittsburgh, Pa. App. filed May 6, 1907. Includes a pair of detachably hinged jars having screw-threaded shanks with a hanger rod into the sleeve which separates the shanks.

931,353. TROLLEY HANGER; T. Varney, Pittsburgh, Pa. App. filed May 1, 1905. For use with a catenary suspension in which the cable has a clamp carrying a pivoted portion adjustable vertically to which the conducting clamping members are secured.

931,354. OVERHEAD LINE CONSTRUCTION FOR ELECTRIC RAILWAYS; T. Varney, Pittsburgh, Pa. App. filed April 5, 1907. For suspending lines of the catenary type in tunnels by means of longitudinally disposed insulating bars having brackets for attaching the bars to the cable.

931,355. TROLLEY CLAMP; T. Varney, Pittsburgh, Pa. App. filed May 6, 1907. The clamp has a cup projecting downwardly containing a pair of jaws with expanded shanks, the outer ends of the jaws gripping the conductor.

931,356. TROLLEY HANGER; T. Varney, Pittsburgh, Pa. App. filed March 9, 1908. The cable carries the trolley conductor by means of two rigid hinged connected links whose combined length may be varied.

931,357. TROLLEY CLAMP; T. Varney, Pittsburgh, Pa. App. filed Nov. 6, 1908. A pair of separable hinged connected jaw members have shanks containing recesses with plugs in the recesses and movable to turn the jar members on their hinges.

931,358. TROLLEY HANGER; T. Varney, Pittsburgh, Pa. App. filed Dec. 31, 1908. The hanger rod carries a conductor clamp with a link between the parts having a movable connection with the rod to limit its movement.

931,366. TROLLEY HANGER AND CLAMP; C. Aalborg, Wilkinsburg, Pa. App. filed Sept. 9, 1907. Two interchangeable jaw members have hollow body portions and projecting sleeves extending into the hollow portions with set nuts on a rod passing through the sleeves.

931,367. HANGER AND CLAMP FOR WIRES AND CABLES; C. Aalborg, Wilkinsburg, Pa. App. filed Sept. 9, 1907. Details in the clamp somewhat like patent 931,366.

931,368. CLAMP FOR TROLLEY CONDUCTORS; C. Aalborg, Wilkinsburg, Pa. App. filed Sept. 9, 1907. The clamp has jaw members and a clamping member engaging inclined surfaces on the jaw member.

931,375. DYNAMO-ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed Sept. 19, 1904. A rotatable field magnet having wedge-shaped poles and previously formed wedge-shaped coils made of strips of conducting material wound edgewise.

931,376. BRUSH STUD SUPPORT; B. A. Behrend, Norwood, Ohio. App. filed Sept. 16, 1905. For supporting and bracing the brush forks to eliminate the vibration.

931,377. AUTOMATIC FIRE ALARM; P. Bonini, New York, N. Y. App. filed Aug. 13, 1908. The circuit closer or thermostat operates levers and is contained within a box, the distance between the points of contact being adjustable from the outside of the box.

931,380. PUSH-BUTTON APPARATUS; R. D. Burk, New York, N. Y. App. filed Oct. 4, 1907. Uses a magneto, instead of a battery, in connection with a push-button to ring a bell.

931,384. MOTOR CONTROLLER; H. W. Cheney, Norwood, Ohio. App. filed Feb. 29, 1908. Fool-proof potential starter for induction motors. Details.

931,385. SECTION INSULATOR; H. B. Clarke, Highland Park, Ill. App. filed May 21, 1906. A section insulator in which the wearing parts are readily detachable and renewable.

931,390. TROLLEY CLAMP; H. P. Davis, Pittsburgh, Pa. App. filed Oct. 5, 1907. A trolley conductor clamp in which the jaws are provided with the hooks engaging a grooved conductor and secured by means of a ring nut and screw.

931,391. TROLLEY CLAMP; H. P. Davis, Pittsburgh, Pa. App. filed Oct. 5, 1907. A trolley conductor hanger in which the jaws are clamped by means of a block, and the height regulated by means of a screw and nut.

931,392. TROLLEY HANGER; H. P. Davis, Pittsburgh, Pa. App. filed April 10, 1908. Includes a triangular frame with cable clamps at two corners, a sleeve member at the third corner, and a trolley clamp having jaws, a gripping sleeve with means for suspending the sleeve so as to permit vertical and longitudinal adjustment.

931,393. TROLLEY CONDUCTOR HANGER; H. P. Davis, Pittsburgh, Pa. App. filed Dec. 14, 1908. The cable carries a clamp with a hanger rod suspended therefrom having a loop engaged by the trolley conductor clamp.

931,397. TROLLEY HANGER; G. B. Dusinberre, Cleveland, Ohio. App. filed Sept. 9, 1907. A pair of identical plates of stamped metal having interlacing jaw teeth and are fulcrumed upon each other to clamp the wire.

931,398. TROLLEY HANGER; G. B. Dusinberre, Cleveland, Ohio. App. filed Dec. 9, 1907. A pair of gripping devices have interlaced teeth for attachment to a supporting wire and to a trolley wire, and also have a single fastening means for both of the gripping devices.

931,399. CABLE HANGER CLAMP; S. B. Dusinberre, Pittsburgh, Pa., and G. B. Dusinberre, Cleveland, Ohio. App. filed Dec. 9, 1907. The clamp includes a bar with a longitudinal slot and a lever with a neck in the slot, and its other parts engaging the faces of the bar.

931,400. TROLLEY HANGER; G. B. Dusinberre, Cleveland, Ohio. App. filed Feb. 25, 1908. The hanger rod is provided with wedges and a nut for operating clamping jaws which hold the wire.

931,404. SYSTEM OF ELECTRICAL DISTRIBUTION; B. Frankerfield, Norwood, Ohio. App. filed March 30, 1907. Electrical connections for shunt-wound motors mechanically connected to a common load, having a shunt-field winding for each of the motors connected in series with a shunt-field winding of another of said motors.

931,408. LIGHTNING ARRESTER; W. Gifford, Traverse City, Mich. App. filed July 24, 1908. Lightning arrester has an impedance coil with a magnetic core included in the circuit between the line and the instrument, and an air gap in a ground branch connected to the line.

931,412. GAS LAMP LIGHTING AND EXTINGUISHING SYSTEM; A. Grossmann, Rheydt, Germany. App. filed Dec. 16, 1908. Details in electrical means utilizing induction coils for lighting gas jets.

931,415. BRUSH HOLDER FOR MOTORS; H. C. Grant, Bayonne, N. J. App. filed Jan. 22, 1908. Has a yoke-shaped member of spring metal with a brush holder of sheet metal engaging the yoke member.

931,416. ELECTRIC MOTOR; H. C. Grant, Bayonne, N. J. App. filed Jan. 22, 1908. A small motor in which screws or bolts are dispensed with and the parts joined by overlapping projections.

931,417. ELECTRIC TOY MOTOR; H. C. Grant, Bayonne, N. J. App. filed June 6, 1908. Details in the construction of a motor and its driven mechanism.

931,445. ELECTROMAGNET COIL CONSTRUCTION; A. A. Low, Horseshoe, N. Y. App. filed Dec. 12, 1908. Employs bare wire, instead of insulating wire, and interposes insulating material in grooves between the wires.

931,448. DYNAMO-ELECTRIC MACHINE; E. Mattman, Milwaukee, Wis. App. filed Jan. 30, 1909. The commutator and armature having skewed commutator leads for causing the cooling.

931,452. TELEPHONE TRANSMITTER MOUTHPIECE; R. E. Miller, Dayton, N. M. App. filed Sept. 24, 1902. For disinfecting mouthpieces, the mouthpiece being made in sections with disinfecting material between the sections.

931,464. METERING PANEL BOARD; A. C. McWilliams, Chicago, Ill. App. filed June 29, 1907. Improvements in a board which may be increased to accommodate an increased number of meters without change.

931,476. INCLOSED FUSE; F. P. Poole, Bridgeport, Conn. App. filed July 8, 1908. The fused link is folded in folds lengthwise of the link.

931,477. INCLOSED FUSE; F. P. Poole, Bridgeport, Conn. App. filed Dec. 17, 1908. The fused link consists of a twisted tube of metal with portions cut away.

931,478. INCLOSED FUSE; F. P. Poole, Bridgeport, Conn. App. filed Dec. 17, 1908. The fused link is 8-shaped in cross-section.

931,507. INSULATOR FOR ELECTRIC WIRES; A. V. Siler, Newark, Ohio. App. filed June 9, 1909. The body portion has a slot receiving the wire, the bottom of the slot being convex. Pins pass over the slot to hold the wire in place.

931,513. ELECTRODE; H. Specketer, Griesheim, Germany. App. filed March 21, 1907. Manufactures electrodes for electrolysis from molten magnetic oxide of iron.

931,518. ELECTRICAL APPLIANCE; J. S. Stewart, New York, N. Y. App. filed Jan. 29, 1908. A socket for incandescent lamps. Details.

931,521. OUTLET BOX CONSTRUCTION; E. W. Stull, Milwaukee, Wis. App. filed April 15, 1909. Details in the construction of an outlet box carrying a lightning arrester and chocking coil.

931,540. ELECTROMAGNET COIL CONSTRUCTION; M. J. Wohl, New York, N. Y., and H. Hertzberg, Brooklyn, N. Y. App. filed April 21, 1908. A solenoid wound with aluminum wire without artificial insulation between the convulsions and having a composite insulating strip between the layers of mica with outer layers of combustible material.

931,541. ELECTROMAGNET COIL CONSTRUCTION; M. J. Wohl, New York, N. Y., and H. Hertzberg, Brooklyn, N. Y. App. filed Nov. 18, 1908. An electromagnet coil wound with alternate turns of copper and aluminum wire.

931,542. ELECTROMAGNET COIL CONSTRUCTION; M. J. Wohl, New York, N. Y., and H. Hertzberg, Brooklyn, N. Y. App. filed Nov. 18, 1908. Electromagnet coil with turns of copper wire and aluminum wire coiled about the copper wire.

931,548. ANNUNCIATOR BOARD; J. Zickel, Berlin, Germany. App. filed Jan. 14, 1909. The annunciator board carries a series of electromagnets in a circle each with an armature and each controlling an annunciator disk.

931,556. DYNAMO-ELECTRIC MACHINE; H. A. Balcome and A. Freier, Boston, Mass. App. filed Feb. 10, 1908. Has a two-part, sheet-steel frame, each part forming a support for the armature shaft and a cylindrical casing carrying the field.

931,566. PICTURE MOLDING; L. Cholet, New York, N. Y. App. filed April 10, 1908. The picture molding is made to project from the wall so as to provide a passage for electric wires.

931,573. CONNECTION BOARD FOR ELECTRIC MACHINES; J. G. Crawford, La Grange, Ill. App. filed Sept. 8, 1906. The front and rear portion of the board have recesses between them with thermal lugs lying therein.

931,586. RECEIVER FOR WIRELESS TELEGRAPHY AND TELEPHONY; S. Eisenstein, Kiew, Russia. App. filed March 27, 1908. A resonant circuit with a primary receiving transformer coil in the circuit together with a secondary transformer coil arranged to be continuously moved with respect to the primary coil and connected to a detector.

931,592. TROLLEY HARP; T. A. Gannoe, Warren, Pa. App. filed April 1, 1908. The trolley harp is provided with a guard for preventing the wheel from jumping the wire.

931,604. SIGNAL DEVICE; H. J. Heeney, Boston, Mass. App. filed Oct. 10, 1907. The signal has a case with an opening in front of glass, which when broken allows access to the signal. Details in the construction of the interior mechanism.

931,605. ELECTRICALLY HEATED GRATE; M. Hermansen and Tygerson, Ephraim, Utah. App. filed May 11, 1908. For heating the water passing to the boiler. Uses two pipes with smaller pipes whose ends are secured to the larger pipe and means for heating them electrically.

931,606. DYNAMO-ELECTRIC MACHINE; F. E. Hirt, Milwaukee, Wis. App. filed May 1, 1909. Improvement in rotors for turbo-generators.

931,613. TRAIN LIGHTING SYSTEM; D. C. Jackson, Madison, Wis. App. filed May 5, 1906. The dynamo is driven by the axle from the train, and the storage battery provided with a switch controlled by the motor.

931,620. DYNAMO-ELECTRIC MACHINE; W. S. Kelley, Brookline, Mass. App. filed Feb. 10, 1908. The field is made up of laminæ with annular clamping members between which the laminæ are clamped.

931,632. ELECTRIC SIGNALING; J. Mladek, Prague, Austria-Hungary. App. filed April 19, 1907. For transmitting impulses of opposite polarity by means of a sensitive spring contact which is maintained in position by the residual magnetism.

931,706. ELECTRIC GROUND CLAMP; F. Stevens, Philadelphia, Pa. App. filed June 4, 1908. The clamp for attachment to pipes includes corrugated sections which interlock with each other.